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**UPDATE ON THE F-35 JOINT STRIKE
FIGHTER PROGRAM**

HEARING

BEFORE THE

SUBCOMMITTEE ON TACTICAL
AIR AND LAND FORCES

OF THE

COMMITTEE ON ARMED SERVICES
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UPDATE ON THE F-35 JOINT STRIKE FIGHTER PROGRAM

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES,
Washington, DC, Wednesday, October 21, 2015.

The subcommittee met, pursuant to call, at 3:35 p.m., in room 2212, Rayburn House Office Building, Hon. Michael R. Turner (chairman of the subcommittee) presiding.

OPENING STATEMENT OF HON. MICHAEL R. TURNER, A REPRESENTATIVE FROM OHIO, CHAIRMAN, SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES

Mr. TURNER. I call this hearing to order of the Subcommittee on Tactical Air and Land Forces.

The subcommittee meets today in open session to receive testimony on the current status of the F-35 Joint Strike Fighter [JSF] program. I would like to welcome our witnesses, Lieutenant General Christopher Bogdan, F-35 Program Executive Officer; and Major General Jeffrey L. Harrigian, Director of the Air Force F-35 Integration Office. Thank you both for your service, and we look forward to your testimony today.

This hearing continues the committee's ongoing oversight of the F-35 program since the program officially began in 2001. We all know that the F-35 is a complex program that has experienced issues with cost, schedule, and performance throughout its development.

This subcommittee has held numerous hearings and briefings to better understand the critical need for the fifth-generation strike fighter capability, and to understand the issues facing the program.

Most recently, the subcommittee visited Eglin Air Force Base where we were able to meet with both pilots and maintenance personnel of the Joint Strike Fighter. It is through this ongoing committee oversight that we have identified issues relating to the program, and in turn, have worked with the Department to help develop corrective actions to ensure the program remains on track. For example, in the fiscal year 2014, the subcommittee learned of software development problems and recommended legislation that would establish a team to review the F-35 software development program and make recommendations to fix these problems.

For fiscal year 2015, the committee recommended legislation that would continue the Government Accountability Office, GAO's assessments and analysis of the development, testing, and production of the F-35 program. During our visit at Eglin, the subcommittee

learned of issues with the F-35 maintenance system known as the Autonomic Logistics Information System, or ALIS, A-L-I-S.

As a result, the subcommittee included a provision in its mark of National Defense Authorization Act [NDAA] for Fiscal Year 2016 that would require the GAO to review the ALIS program and provide a report to the congressional defense committees by April 1, 2016.

The committee also recommended a provision that would require a review of the F-35 engine program by a federally funded research and development center to ensure that future engines will not be subject to the failure that caused an F-35 engine fire on takeoff just last June.

Each of the subcommittee's legislative recommendations over the past 3 years have been adopted in the annual National Defense Authorization Act. In the past month, the subcommittee has learned that the ejection seat does not meet the design specifications for lighter weight pilots. The specification for the ejection seat is that it needs to be able to accommodate a safe escape at pilot weights of 103 to 245 pounds. We understand that until this deficiency is corrected, pilots weighing less than 136 pounds will not fly the F-35 due to a high risk of serious injury that could result from having to eject. We look forward to our witnesses addressing this issue today and the plans to get this problem corrected.

In closing, while strong oversight of the F-35 remains necessary, the value of the fifth-generation stealth aircraft is absolutely assured, like the F-35. In future conflicts, it is absolutely critical to successfully address these emerging threats and maintain air dominance in any overseas contingency operation.

I look forward to all of our witnesses today and expect to hear from them what follow-up actions the program is undertaking to address the issues identified as a result of our delegation's visits to Eglin.

Before we begin, I would also like to thank all of our colleagues. Ms. Loretta Sanchez has been detained. But as ranking member, when she returns if she would like at that point to offer her opening statement we will get to her opening statement.

With that, we will begin then with General Bogdan.

[The prepared statement of Mr. Turner can be found in the Appendix on page 29.]

**STATEMENT OF LT GEN CHRISTOPHER C. BOGDAN, USAF,
PROGRAM EXECUTIVE OFFICER, F-35 JOINT PROGRAM OFFICE,
U.S. DEPARTMENT OF DEFENSE**

General BOGDAN. Thank you, sir. Chairman Turner and distinguished members of the committee, thank you for this opportunity to address you regarding the F-35 Lightning II program. I am pleased to be joined today by General Harrigian, the Air Force's F-35 Integration Office lead.

The F-35 Lightning II is of vital importance to our national security. And as the program executive officer [PEO] and program director, I'm committed to delivering an affordable, reliable, and sustainable fifth-generation fighter to our warfighters. The F-35 will form the backbone of U.S. air combat superiority for decades to come. It will replace legacy tactical fighter fleets of the Air Force,

Navy, Marine Corps with a dominant multirole fifth-generation aircraft capable of projecting U.S. power and deterring potential adversaries.

For our international partners and foreign military sales customers who are participating in the program, the F-35 will become a linchpin for future coalition operations and will help to close a crucial capability gap that will enhance the strength of our security alliances.

The F-35 program today is executing well across the entire spectrum of acquisition to include development and design, flight test, production, fielding and base standup, sustainment of fielded aircraft, and building a global sustainment enterprise.

The program is at a pivot point today where we are moving from slow and steady progress to what I call a rapidly growing and accelerating program. However, the program is not without risks and challenges, as these come with any program of this size and complexity. I'm confident that the current risks will be resolved and we will be able to overcome any future problems and deliver the full F-35 combat capability, including the U.S. Air Force [USAF] and Navy initial operating capability [IOC] declarations, in the future.

Since the last time I appeared before this committee, the program has successfully completed a number of important events, not the least of which was helping the U.S. Marine Corps declare initial operating capability this summer. A few of this year's accomplishments include the beginning of our Block 3F, our final version of software, in flight test. Two successful ship trials, one for the U.S. Marine Corps above the USS *Wasp*, and one for the U.S. Navy on the USS *Eisenhower*.

We delivered the first three IOC aircraft to the Air Force at Hill Air Force Base last month and delivery of the U.K. [United Kingdom] and Dutch aircraft at Edwards Air Force Base for participation in operational tests this summer.

The rollout of the first flight, in-flight of the Italian F-35A from our FACO [fabrication, assembly and checkout], which is our fabrication and checkout facility in Italy last month. We also rolled out our first Norwegian aircraft. We have also completed the qualification of Australian and Italian air refueling tankers with the F-35. We have also started the ground testing of our 25 millimeter cannon months earlier than we originally planned.

And just recently, we started U.S. Air Force and partner training at Luke Air Force Base. These are just a few of the accomplishments since the last time I spoke with you.

Overall, the program has made good progress in development and flight tests. We are now about 75 percent complete with the entire flight test program. We still have technical deficiencies to correct, including the ejection seat, which we will talk about today, the Autonomic Logistics Information System, or ALIS, which I plan on talking about today, and various fuel system and structural shortfalls. But we have corrections in place for all of these issues and will be able to implement the solutions in the near future.

With respect to aircraft production, the production line is becoming more efficient each and every day, and the price of all three variants continues to drop lot after lot. I expect this trend to continue well into the 2020s, and still believe that we can achieve our

price target of an F-35A model with an engine, with fee, in fiscal year 2019 dollars, of about \$80- to \$85 million.

We are closely monitoring the supply base as we begin to prepare for a ramp-up in production from 59 airplanes in lot 8, to 104 airplanes in lot 9, to 123 airplanes in lot 10, up to a final production rate of nearly 170 airplanes per year in the early 2020s.

We are also seeing some improvements in the reliability and maintainability of the aircraft as a result of focused efforts on the supply chain, the repair cycle time of spare parts, spare part availabilities, and improved maintenance procedures. We are also on track with our organic depot standup, both in the United States, and in the Pacific and European regions. We have begun the requirements validation and the initial acquisition planning for a follow-on modernization program that will begin at the end of our current development program in October of 2017.

I am committed to establishing a lean, effective, modernization program with the appropriate government control and oversight to ensure that remains both affordable and transparent, while at the same time, effectively enhancing the F-35's capability for decades to come.

With respect to risk and challenges, I see the completion of mission systems software development, ALIS development, and the previously mentioned fuel system and ejection seat deficiencies as our most prominent, current, technical risks. Our ability to stand up four separate reprogramming labs that create mission data files in time for all of our customers, and our ability to complete all the weapons envelope testing for Block 3F, as well as our ability to start OT, on time, are the major schedule risks to the program today.

I will close by saying that I believe the programming is in a better position today than it was 1, 2, or 3 years ago. It is a growing and accelerating program that is making solid progress. The weapon system design is sound. The program is fundamentally on track. We remain confident that we will be able to deliver the full F-35 capability within the time and the money we have been given.

As with any big, complex program, new discoveries, challenges, and obstacles will occur. However, we believe the combined government-industry team has the ability to overcome our current deficiencies and deal with future issues should they arise in order to successfully deliver on our commitments.

The Joint Program Office [JPO] will continue executing with integrity, discipline, transparency, and accountability, holding ourselves accountable for the outcomes on this program. We recognize the responsibility the program has been given to provide the backbone of future U.S. and allied fighter capability for generations to come. We also recognize that our sons and daughters and our grandsons and granddaughters may some day take this weapon system into harm's way to defend our freedom and way of life. It is a responsibility that we never forget in the Program Office.

Thank you again for this opportunity and I look forward to answering all your questions.

[The prepared statement of General Bogdan can be found in the Appendix on page 31.]

Mr. TURNER. Thanks. General Harrigian.

**STATEMENT OF MAJ GEN JEFFREY L. HARRIGIAN, USAF,
DIRECTOR, F-35 INTEGRATION OFFICE, U.S. AIR FORCE**

General HARRIGIAN. Thank you, sir. Chairman Turner, distinguished members of the Tactical Air and Land Forces Subcommittee, thank you for the opportunity to provide an update on the United States Air Force's progress toward delivering initial operating capability, IOC, for the F-35A.

A combination of F-35 lethality, survivability, and adaptability, make it our platform of choice for operations in a highly contested threat environment. The aircraft state-of-the-art sensor fusion, network interoperability, and broad array of advanced air-to-air and air-to-surface munitions, enable unmatched lethality well into the 21st century.

The F-35's exceptional survivability is achieved through a combination of low-observable technologies, advanced electronic attack and electronic protection, and shared situational awareness. It will form the backbone of future joint and combined air operations enabling future joint force commander success.

Today, sir, we have 79 F-35As delivered, and they have flown over 21,000 hours in our Air Force. The program is on the road to IOC for the Air Force. Specifically within the last 2 months, we received our first three aircraft at Hill Air Force Base, and are flying them now at a high rate.

This month, Air Force operational testers are flying with our IOC software load and building F-35 tactics, techniques, and procedures. We have work to be done, though. Specifically, we are concerned about the software capability we will get in our IOC load, ALIS software delivery, and the modification schedule for our jets at Hill. All that notwithstanding, we expect to declare IOC as planned in 2016.

However, this is still a program in development, and challenges remain. We will continue to work closely with the Joint Program Office, Lockheed Martin, to ensure we achieve full warfighting capability. While IOC is an important milestone for the program, we must not lose sight of the goal of full warfighting capability. The program must develop and deliver 3F software on time. And we need to invest now in Block 4 follow-on modernization to provide the warfighter with the most current and relevant capabilities required to meet the future threat.

The capability advantage that the Air Force had enjoyed over potential adversaries is closing fast. And in modern warfare, if the Air Force fails, the joint force fails.

Thank you again for this opportunity to discuss the F-35. I look forward to answering your questions. Thank you, sir.

[The prepared statement of General Harrigian can be found in the Appendix on page 55.]

Mr. TURNER. I thank both of you. I have just got a couple of questions to get things started off. We have a number of members who have questions; want to make sure we get through everyone.

General Bogdan, the ejection seat. Obviously it is not performing. This is supposed to be life-saving, not life-threatening. Could you share with us more information about this? What is the problem? How is it being fixed? And what does it take to implement the correction?

General BOGDAN. Yes, Congressman. If you will indulge me, it is a complex problem, so I will spend a little bit of time trying to clear up some of the misinformation that you might have.

First and foremost, safety is always paramount in the program for me and my team. I would never, ever ask a pilot to do anything that I wouldn't do myself. And the airworthiness authorities that work with me on the Navy side and the Air Force side feel and act the same way. So we take this deficiency with the ejection seat and the safe escape very, very seriously. And let me explain what the problem is and what we are doing about it.

So as we begin, as you said, Congressman, the ejection seat we have in this airplane was designed to cover the widest range of pilot weights and sizes that we have ever had in a fighter airplane. The seat and the ejection system is designed to deal with pilots down to 103 pounds all the way up to 245 pounds as you said. But it is also designed for different size pilots from the smallest pilots anthropometrically to the largest pilots. And the combination of the weight and the size means that we will be able to put more pilots in this airplane than any other legacy airplane before it.

We do have deficiencies. We have found those deficiencies through the normal testing process. We have a number of deficiencies with the ejection seat, not all of which were found just recently. We have been testing the ejection seat for many, many years. And when you start testing a system like the ejection seat, what you do is you start from what we call the center of the envelope of that ejection seat, meaning the average weight, the average speed, the average altitude, and then you work your way outside to the edges of that envelope. And as you get out to the edges of the envelope in terms of speed and in terms of the weight of the pilots, things become more severe and are harder to achieve in terms of safety.

The test that occurred on 27 August of this year that resulted in the Air Force and the Navy restricting pilots below 136 pounds was a test at the very edge of that envelope. It was a low-speed test, with the lowest weight pilots we have. And if you drew that envelope, it would be on the very, very corner of it. So it is a difficult place to be able to design the ejection seat for. But having said that, after that test, we recognized that there was a deficiency.

That is a different deficiency than a few of the other deficiencies I am going to talk about which encompass all of the problems that we are having with the ejection seat. So let me start and talk about a few of the other issues that we have had on the seat that we are in the process of fixing, and then I will get to the last problem, the one in which resulted in restricting pilots less than 136 pounds, because all the other problems that I am going to talk about came with no restrictions. We continued to fly with all sizes and all weights of pilots.

So, in the ejection sequence, there are three important portions of that process. The first is what we call catapult, when the seat gets blasted out of the airplane. For a lightweight pilot today, less than 136 pounds, when he or she goes up the rails of the airplane in that catapult, his or her neck gets pushed down like that.

When we initially did the testing on that condition, what we found was if the pilot has the helmet on his head or her head, and

that helmet weighs more than 4.8 pounds, then the neck loads for that lightweight pilot, by a very little bit, exceed what we would consider to be perfectly safe. So what did we do? The first thing we did was we began taking weight out of the helmet to ensure that every helmet we have is going to be weighing less than 4.8 pounds.

Today, our helmets weigh about 5.1 pounds, so we are talking about 6 ounces of weight to get out of the helmet. We are developing that new helmet that weighs less than 4.8 pounds today. We never had to restrict lightweight pilots for that catapult phase because the neck loads that they would experience with that, even with that heavier helmet, were so close to the safety limits that the airworthiness authorities thought that that risk was quite acceptable. And I agreed with that. I did the risk assessment with my team and I give it to the airworthiness authorities, and they decide. So that was problem number one, which we are fixing with a lighter weight helmet today that resulted in no restrictions on who could fly the airplane.

The second problem is once the ejection seat leaves the airplane, you get wind blast, that is because the ejection seat is moving at hundreds of miles an hour, and as it comes away from the airplane, it is almost as if you put your hand out of your car as you are driving and you feel that wind blast.

In this instance here, the pilot's head gets forced backward instead of forward. Once again, in our testing what we found out was if a lightweight pilot, less than 136 pounds, has a helmet that weighs more than 4.8 pounds, then that neck stress going backwards is higher than what we would like it to be, but not so high as that we would need to have restricted pilots from flying the airplane.

So the solution to both those problems, the catapult problem and wind blast problem, are to reduce the weight of the helmet. We have been ongoing with the development of the new helmet and the new weight for about 6 months. It will take about another year for us to finish that to ensure that every helmet is less than 4.8 pounds.

We did have one pilot at this period of time that was flying the airplane that was less than 136 pounds. And the reason why that pilot could continue to fly, even with those known risks, was because we hand-built him a helmet that weighed 4.7 pounds. We cannot manufacture today on the production line in any mass quantity a helmet that weighs less than 4.8 pounds, that is why we are redesigning it. But for that particular pilot, we took pieces and parts and we fabricated a helmet that weighed less than 4.8 pounds; that was why that pilot, even during this known-risk area, was able to continue to fly. So those are two problems being solved with one solution that we should have done in about a year.

The third problem we found during normal testing occurs in what we call the opening shock phase of the ejection when the parachute on the back of the seat comes out. In this instance here, when that parachute comes out, once again, the pilot's head moves forward. In this instance here, the only pilots that are affected by the opening shock being too strong and causing the neck loads to be above what we would consider safe is, once again, that lightweight pilot.

The risk of that happening, though, was low enough that the airworthiness authorities felt that it was not significant enough to have to restrict anybody from flying the airplane when we found that problem. But when we did find that problem, and we found that one probably about 8 or 9 months ago in normal testing, we already began a solution.

The solution to that problem for the lightweight pilot is just to delay that parachute coming out by a fraction of a second. Because as the seat comes out and hits the wind blast, it begins to decelerate. And if you wait just a fraction of a second before you put that main chute out, the seat has decelerated enough so that the force when the parachute comes out isn't as severe. To get to that solution, we are putting a little switch on the side of the ejection seat that when the pilot climbs up into the cockpit, can set that at heavyweight or lightweight.

There were a number of ways we could have solved that problem. We could have put an automatic sensing system into the seat, much like when you sit in your car on the passenger side and the seat knows you are there and the air bag gets energized. We also could have put a switch on the seat that would have had the maintainers put it in the heavy- or lightweight position. We went back to the warfighters and we said, What solution do you want? Because we can solve this problem in a number of ways. And they said "we want the pilot to be responsible for moving that switch. We want he or she to be responsible for ensuring that it is in the right position for their safety." Thus, we are building that switch on the side of the seat; as the pilot climbs up, they can go light or heavy.

Mr. TURNER. General, as I said, we have a number of people who want to ask questions, so I am going to cut you off at that point.

General BOGDAN. Okay.

Mr. TURNER. Thank you for the in-depth description of that issue and problem. Obviously there are two aspects of it. One, finding a solution; and two, its implementation of the solution. So we are looking forward to both your confirmation of if all the problems have been identified, and two, the implementation of the solutions in a manner where our committee can be satisfied that those really will address the issues.

General BOGDAN. Yes, sir.

Mr. TURNER. Now, General Harrigian, the—everybody on the committee recognizes the need for F-35 capability, everybody recognizes that not having the F-35 capability goes to an issue of our no longer having air dominance. It is we win versus we lose. Everybody recognizes that one of the difficulties and problems with this program has been the concurrency, that we are both inventing at the same time that we are producing, and that as a result of that, we will have delays, cost overruns, and at times, there will be problems that will have to be identified that then need to be fixed, as General Bogdan was just testifying. There have been obviously a number of those.

But the biggest concern that we all have is not as problems arise, can they be addressed, but an assurance that when we get to the end, that this F-35 capability that we all know we need is actually

the capacity that we demanded, that that plane performs as it is supposed to.

Now, January 25 flight tests demonstrated that the F-35 was not as maneuverable as an F-16, that the aircraft is supposed to replace in a dogfight. Can you comment on the conclusions of that test and the implications of the F-35 in combat?

General HARRIGAN. Yes, sir, Chairman. To go back to that flight test, as a reminder, that was one of the very first developmental test sorties that were flown to better understand the slow-flight characteristics of the airplane. Since that initial sortie, we have now been able to put the airplane in the hands of our operational testers. So these are the folks that are now ringing out the tactics, techniques, and procedures for how we will fly the airplane in combat.

In fact, sir, over the course of the last month, they have been developing some specific exercises to better understand the characteristics of the airplane, and that would include post-stall acceleration, how the airplane turns, to prepare them to do what we would call basic fighter maneuvers, which is where they fight one against one to see how the airplane performs in both an offensive and defensive perspective.

Sir, the results of that, and I can share with you that I just talked with them last Friday, is they have been very pleasantly surprised on how the airplane is performing, it has been very positive. What they are finding is that as they arrive in the post-stall regime, the airplane is extremely stable, so stable, in fact, that as they began the testing, they initially had 150 knots minimum air speed requirement. They have since removed that. And that is how we are going to go out and train, with no minimum air speed requirement, which is really a testament to how well the airplane is performing.

In that environment we will continue to learn. What I would offer to you is that we are still in the nascent phases of fully understanding how the airplane will employ in that environment. But that capability, in my mind, is going to be there.

I would offer to you that as one of the early F-22 pilots that I was, we had some of the same learning curve issues. We had to go out and fly the airplane and fully understand across the regime of where we were going to employ it, how to best get the most out of the airplane. That is what we are going to do, and I think the airplane is going to deliver, sir.

Mr. TURNER. I appreciate your reference to that. Even the Wright brothers, after they invented the plane, had to learn to become pilots. We appreciate that process.

I want to ask unanimous consent that non-subcommittee members, which currently include Ms. Speier and Mr. Lamborn, be allowed to participate in today's hearing, and Mr. Cooper. After all subcommittee members have had an opportunity to ask questions.

If I hear no objections, non-subcommittee members will be recognized at the appropriate time for 5 minutes. Turning now to the next questioner, which will be Mr. Walz.

Mr. WALZ. Thank you, Mr. Chairman, and Generals, thank you for taking the time to come and for continuing to update us on this. I think it is critically important.

I want to go back to April's hearing, because I think it is important for us to build on what we asked and to get on. And in that hearing, I asked what is our next hearing going to look like when we come? And at that point in time, Secretary Stackley said, "We will have the United States Marine Corps version, completion of 3i testing and 3F testing, and we will be able to see the end of R&D [research and development] costs." Are those things panning out?

General BOGDAN. The Marine Corps has declared IOC and is flying operational missions at Yuma today, sir, so I would put a check in that box. We are completed with all mission system testing for 3i. We intend on delivering that 3i software to the field in January. As General Harrigian said, we have already handed that software to the OT [operational testers] testers so they can wring it out. So I would put a check mark there.

For 3F, I am not sure if Mr. Stackley was referencing when we would have 3F done. But I have always contended and always told this committee that I thought that the schedule for 3F had about 4 to 6 months of risk in it.

I just recently did another schedule risk analysis and took a look at our schedule and our plans. What I will tell you is that that 4- to 6-month risk is now down to about 3 to 4 months. And we believe that the full 3F software capability on this airplane for the A model will be out into the field in August of 2017. That is a good year before the Navy needs it for IOC, and a good 6 months before the SECDEF [Secretary of Defense] has to certify that the airplane is going to be fully 3F capable.

So I think that risk is working its way down. As we get out of the business of testing 2B, which we are done with, and 3i, the entire test fleet now is being transferred over to 3F, and therefore, I think we are going to be catching up.

Mr. WALZ. Thank you, General, that is helpful. I think it is important for us to see where we are at, and it is hard to get exactly right. Can you explain to me what the concurrence is with the Marine Corps on where I am getting the folks that there is a little bit of controversy on what they are saying, they are flying their IOC. That is for their mission what they need to have done. It is good with them.

General HARRIGIAN. Yes, sir. In fact, I would say that they are now flying the airplane operationally. They are out employing the airplane in the missions that they had described for their IOC. And I think the result has been very positive and the feedback from them has been well received.

General BOGDAN. Sir, I might add that the services defined for me what they need to declare IOC. And the U.S. Marine Corps takes a look at the legacy airplanes that they have and how they intend on employing the airplane, and they created a list of criteria that they needed to meet to declare IOC. The Air Force has done the same thing. They are different lists, because the Air Force intends on using the F-35 differently than the Marine Corps.

My promise to the Air Force is, I will give them everything they need to declare IOC by August of 2016. But they will fly the airplane differently and use it in a different way than the Marine Corps.

Mr. WALZ. Okay. And General Bogdan, you did a nice job last time of explaining to a layman what happened with that June 23 fire, the heat issue and all of that. Where is that at, at this point, in terms of corrections?

General BOGDAN. Sir, we have already validated the full correction to the engine problem. Every engine coming off the production line since about 7 months ago had the fix in it so we are producing fully capable engines right on the production line. We have 134 airplanes out in the field today. Sixty-one of them have been retrofit with the new parts so that there is no longer a restriction on them, that is about 44 percent. By June of 2016, all 134 fielded airplanes will have the same fix in them that the production airplanes are now going down the production line with. So in my mind, it was a problem, it was unfortunate, but we are putting it behind us.

Mr. WALZ. Did we learn anything that goes beyond the specific issue in that in terms of the testing standard in that of what we can extrapolate going forward from that incident?

General BOGDAN. Yeah, one of the things that we did learn was that the design of that portion of the engine is very similar to other fighters that we have, and there was an assumption made that since those other fighters didn't have this problem, that the F-35 wouldn't have this problem. So some of the engineering analysis I won't say it was shortcut, because that is not the right word, but some of the assumptions that they made in the original engineering analysis assumed that the engine was going to react as if it were in the other airplane, and that was not the case. And that was not the case because the F-35 maneuvers differently than any other airplane, and the engine actually shifts and moves and bends differently than that other airplane, causing that.

Mr. WALZ. So will that change now as we go forward? I hate to use the term—we assume that they will not do that in the future, that they will go back to the beginning?

General BOGDAN. So part of what we did was we ensured that the models that both the government and the engine manufacturer, Pratt & Whitney, was using, incorporated the new knowledge about the F-35 and the assumptions that we made when we first designed it. So at least for this engine, sir, we are not going make that same kind of mistake, and Pratt & Whitney has learned that lesson.

Mr. WALZ. I thank you. I yield back, Mr. Chairman.

Mr. TURNER. Thank you. Mr. Cook.

Mr. COOK. Thank you, Mr. Chairman. Generals, there was an election this week in Canada, and it appears Mr. Trudeau is going to be the winner of that election. Correct me if I am wrong, but I believe he made some preelection statements that Canada would not purchase the F-35s, and I think they were in for 65. So the question is about affordability. If a partner drops out of that, and I don't even know—I am not a lawyer, I am dangerous enough as a Marine at one time—is that going to have an impact on cost, or what have you?

General BOGDAN. I am pretty sure this is my question. So let me start off by saying, it wouldn't be appropriate for me to speculate what Canada will or won't do, so I won't provide any opinion about that. But—and I will also tell you that I have received no official

notification from Canada about the change in status for them today.

Having said that, I am prepared to tell you what the impact to the program would be if that were the case and let me explain that to you. So first, the current development program that ends in 2017 would have—there would be no effect whatsoever if Canada were no longer a partner, because they had paid all the money into the development program, and all the services have already paid, and we intend on finishing the development program with the money we have. So there would be no effect on the current development program.

Not the case for production and the price of the airplane. If any partner, or any service, moves airplanes to the right or takes airplanes out, the price of the airplane for all the other partners and all the other FMS [foreign military sales] customers, and all the other services goes up a little bit.

In this instance, if there are 65 less A model airplanes in that production profile from any country, whether it be Canada or someone else, we have estimated that the increase in price to everyone else is about .7 to 1 percent. For an A model today that is about \$1 million a copy for everybody else. So there is an impact to the price of the airplane for everyone else if 65 airplanes are removed from the production flow.

There are other impacts. Going forward, we have a follow-on modernization program, and we have future sustainment of the airplane that the partnership shares in that cost. Canada's share of that cost was 2.1 percent. So if Canada is no longer in the program, that 2.1 percent cost of future sustainment and follow-on modernization will have to be spread among the other partners and the other U.S. services, because that is a cost that has to be paid and it wouldn't be paid by a partner who is no longer a partner.

The last one has to do with industrial participation. Today, there are many Canadian companies building pieces and parts for the F-35 program. We do not have a set rule as to what happens to that industrial participation if a partner reduces airplanes, adds airplanes, or even leaves the program. There are no set rules. But it is my opinion that the remaining partners and our industry partners are going to have a discussion about what to do with all of the industry in Canada that is building pieces and parts for the airplane.

Mr. COOK. Thank you, General. I have one more question. I apologize for the nature of the question, this is an infantry guy who is going to ask a logistics question. I did have to serve as a logistics officer, and it left an indelible mark on me, and not very good, I might add. You know we get more and more briefs about the engine, everything else, and I am thinking about the maintenance of a brand new fifth-generation aircraft that, I guess would be fourth and fifth maintenance, or degrees of maintenance that we would have to do. Do we have the parts and the technicians that are in place right away to handle this very, very sophisticated piece of gear, or are we going to have to change on the fly, and is there money available for that?

General BOGDAN. So I will answer the first part of that and I will let General Harrigan give you the Air Force's perspective. As the

airplane continues to mature, we are building a maintenance force through training at Eglin Air Force Base that continues to have to understand the changes we make to the airplane, because we are not done developing it. And older airplanes, believe it or not, are being maintained differently than the newer airplanes, because quite frankly, the newer airplanes are in better shape. So we will have to continue to update the maintenance manuals, the parts supply chain and things until we get the fleet of airplanes up to a common standard.

It is a problem that occurs on most programs. We have it a little more severe because of the level of concurrency we have. But you are right, Congressman, that we will have to continue to train our workforce as we continue to change the airplane, and I don't think that will change for quite a while.

Mr. COOK. Thank you.

Mr. TURNER. Mr. Moulton.

Mr. MOULTON. I thank you, Mr. Chairman. Gentlemen thank you very much for your service and for taking on this difficult project. I know you haven't been asked to bring the best looking date to the dance, and that is not an easy thing to do.

You know, I am new to this relatively, my background is also as an infantryman. And I have always taken the perspective on the F-35 that there are a lot of mistakes that have been made, there have been an awful lot of cost funds that have been arguably wasted over the years. This is far more expensive than any of us anticipated. But we are far enough down the line now where we just have to make it work. Would you agree with that statement?

General BOGDAN. Sir, I would agree that without armchair quarterbacking or trying to figure out why decisions were made in the past, that we have incurred significant schedule and cost increases in the past on the program. Some of them are normal to programs, others were results of decisions that were made.

What I would like to add, though, is since we rebaselined the program in 2011, we have not had a single cost increase and we have not asked the Congress or the partners for an added penny since 2011. So I believe—

Mr. MOULTON. It is a great achievement, but it is quite a baseline.

General BOGDAN. Yes, sir. I would agree with you that in 2011 when we rebaselined, we added 2 years and a few billion dollars to the program.

Mr. MOULTON. Now several of the analysts I have spoken to have commented that one of the fundamental mistakes may have been trying to incorporate so many mission capabilities into a single aircraft, rather than having aircraft built for more specific specifications. I mean, the F-22 program in contrast to the F-35, I think most folks think is quite successful. Would you agree with that statement as well?

General BOGDAN. I know very little about the F-22 program, so I will ask General Harrigian, who flew the airplane, to maybe comment on that.

General HARRIGIAN. Sir, the only comment I would offer to you is that in the early years of F-22, we had some of the very similar types of problems from software fusions, taking software from the

lab and making it work in the airplane. And quite frankly, I think that is why the Chief asked me to do this job, because there were some lessons that we needed to make sure were brought forward into the F-35.

So my response would be while single-mission airplanes which initially we thought the F-22 was going to be, we ended up making it multi-mission because we needed it for capacity across the joint fight. My perspective would be as we looked at the F-35, we needed it to be able to accomplish several mission sets, so that as we looked into the future we had the capacity we needed to execute all those different missions for the joint force commander.

Mr. MOULTON. Thank you. I guess where I am coming at fundamentally is that there are an awful lot of folks here on the committee I think, and in Congress in general, who feel like we have invested a lot of money, and we have got to make sure this thing works. But at a basic level you don't make economic decisions based on sunk cost. I mean, that is a pretty fundamental economic principle. And so my question is, who in the Air Force is looking at this project from a much higher level and saying, is this still the best decision to buy the number of airplanes that we have, or should we be talking about potentially, not for certain, but potentially devoting resources to accelerating the development of the next generation of aircraft, or perhaps accelerating the development of the next generation of aircraft, multiple, that would fulfill different mission sets, and maybe not be susceptible to the same problems this program has encountered?

General HARRIGAN. Yes, sir. In fact, the Chief has directed, and they are actually reporting to him, what is called an enterprise capability team to get exactly after your question of as we look into 2030, what should this look like? As we go forward, and we look at the required mix of what capabilities we need versus the future threats that we envision out there, what is the right mix of capabilities that the Air Force will need? They are there to report out to him in the early part of next year, and I think that will be a real good opportunity to get a better understanding of how we see ourselves moving forward.

Mr. MOULTON. Thank you very much. Mr. Chairman, I would respectfully request that we entertain that discussion as part of our debate about the F-35, because I think it is very easy in this environment to get so consumed with the challenges and problems of this one program, to not be thinking ahead from a perspective that we shouldn't be basing decisions on sunk costs, and think about what the best decisions are going forward to meet the threats of 2030, which could, indeed, include cutting back on the current program. Thank you very much. And I yield my time.

Mr. TURNER. And I will invite you. We go down to Eglin on a regular basis to actually look at the operation of the plane, and we have a number of classified briefings that will give you a greater fidelity of what this plane actually does, and what the needs and threats are. And I think at that point, you will probably be very satisfied. I appreciate that we continuously ask that question. It is not a question that we should never stop asking, but I do think as you become more familiar with both what the operational capabilities of this plane are, and the current threats which is what this

plane is designed to address as they're evolving, that you will similarly come to the same conclusion that we did in the National Defense Authorization Act.

Mr. MOULTON. We shall see, Mr. Chairman.

Mr. TURNER. I am going to Martha McSally.

Ms. MCSALLY. Thank you, Mr. Chairman. And thank you gentlemen. Let me first say that I am one of those pilots that would be at the quote, unquote, "edge of the envelope" of what you talked about there. Would have to gain about 15 pounds in order to be able to fly the F-35 today. Just so I understand, the little switcheroo thing you are talking about that the pilots are going to have to move, delaying the chute coming out, is that putting them at increased risk though, in, like, a zero-zero situation, where obviously every nanosecond actually counts?

General BOGDAN. Yeah, actually as it turns out, ma'am, for a lightweight pilot, delaying the opening of the chute until the seats slows down does not increase at all the risk of ground impact or that pilot getting out of the seat because a lightweight pilot in a catapult phase gets shot up higher.

Ms. MCSALLY. Okay, got it.

General BOGDAN. We had margin

Ms. MCSALLY. Got it. Okay. Thank you. And let me first say, like the chairman said, we need a fifth-generation fighter capability, strong supporter of us developing this capability. As an airman myself, people take, I think sometimes for granted air superiority and what that takes, with our near peers in making sure we have denied access. I have been to the factory myself and strongly support us developing this capability for national security and our warfighter. But I am concerned about this airplane is replacing all of our legacy fighters and the whole "jack all trades, master of none," and specifically, it replacing the A-10 in the close air support [CAS] missions that it uniquely brings to the fight.

When we talked in April, we had a discussion about some limitations in that replacement of the unique capability in close air support. And I will just run through them just as a reminder. In the A model, some of these were night capability, lack of the ability to pass nine lines via data, time on station being 20 to 30 minutes. But then even in the follow-on capabilities, the munitions only 180 bullets, time on station being only 45 minutes, and Dr. Gilmore agreed that the F-35 would not be able to survive a direct hit like the A-10 can, and still allow the pilot to at least fly to friendly territory so that they are not taken POW [prisoner of war] and lit on fire in a cage like we have seen happen to the Jordanian pilot. So these are really important capabilities.

So the shortfalls were identified in the April hearing. I was glad to see that in August, Dr. Gilmore announced that there would be a head-to-head test against the A-10 and the F-35, but I don't want to put words in your mouth. I think you were not supportive of that test, and I think you said it wasn't a good use of taxpayers' money. I disagree with you there, General Bogdan. I think it is a very good use of taxpayers' money.

And if the F-35 is going to replace the A-10, we need to identify whether we are going to have a decrease in the unique capabilities in that mission set, and that includes the loiter time, the lethality,

1,174 bullets, the ability to take a direct hit, and all that the A-10 brings to the fight.

So I just wanted to get your perspective on the record about the head-to-head test, how that came about. And also, I am skeptical about it, quite frankly, with all the things we have seen the Air Force trying to do to go against the will of this Congress and back door retiring the A-10. You can set up a test to have any sort of result you want, you know. So is the test going to specifically address not high-end, high-sophisticated air defense circumstances, but where we have air superiority and those unique capabilities of the loiter time, the lethality, the maneuverability, and to do a continuous cast and take a direct hit, will that be a part of that test?

General HARRIGAN. Ma'am, if you don't mind, I will come back first. I think—probably familiar that the Chief came back and said we are supportive of executing comparative testing.

Ms. MCSALLY. After he called it silly, but yes.

General HARRIGAN. And so at this point right now, we are working closely with our Air Force Operational Test Center [OTC] folks. We are working closely with DOT&E [Director, Operational Test and Evaluation] to formulate exactly what that test will look like.

Ms. MCSALLY. Okay.

General HARRIGAN. Specifically looking at multiple scenarios, both in contested and permissive environments, looking at different ranges, time to arrive on target, loiter time, all those types of things will be incorporated for the appropriate analysis to ensure that at the end of the day, we are delivering the platform that is effective and suitable in the environments we are going to operate it in.

Ms. MCSALLY. Great. I am interested in continuing to interact and see how that test is going.

General Bogdan, do you have anything else to add?

General BOGDAN. Yes, ma'am. What you described just now was exactly what I think should be done with the F-35, and that is, test it in a realistic operational environment for the CAS mission that the Air Force intends the F-35 to do, not the CAS mission that the Air Force intends the F-35 to do looking like an A-10.

The problem that I have is, that money that I am going to spend doing the testing on the A-10 could be used elsewhere, and I know the outcome of that test.

I will give you an example. You have a decathlete in the Olympics, and you have a 100-meter sprinter. If I put the 100-meter sprinter and the decathlete on the starting line for a 100-meter sprint, I don't have to run that race to know who is going to win it. I don't need to test the A-10 to figure out what the F-35 can do in a close air support role. What I would prefer to do is test the F-35 in its close air support role as the Air Force sees the requirements for that mission for the F-35.

Ms. MCSALLY. I hear you, and I am out of time, but I think us envisioning that we are never going to have close air support where guys are on the run, they are out of ammo, they are doing a mirror flash into your eye, they don't have time to do standoff CAS because of the complex circumstances. If we think that is never going to happen again, I think we are—

Mr. TURNER. You are correct, you are out of time.

Ms. MCSALLY. Okay. Thank you, Mr. Chairman.

Mr. TURNER. Thank you. Ranking Member Sanchez.

Ms. SANCHEZ. Thank you, Mr. Chairman, and first of all thank you for holding this, because as you know, you and I have been through a lot of growing pains on this F-35 program and I know people have mentioned they have been down to the factory. Well we have been to the factory, and we have been to the factory overseas, and we have been to see them in action, and we have been to talk to the pilots, and we have been and we have been and we have been. So what we have on our hands is the fact this is going to be our production plane for the future, and so we have to make sure that it is the best that we have, the best that we need. I think the gentlelady from Arizona is correct in saying that, you know, that she supports this.

And I also am glad for her knowledge of fighter planes, and I don't know if I am glad for your persistence on keeping the A-10, I don't know where I am on that really, but I am glad that you are on and you are asking the questions and that you keep hitting it because we need to. As well—I am sorry for coming late, but I also heard the gentleman from Massachusetts have some concerns and some follow-up, so that is the role of this subcommittee.

So thank you to my fellow colleagues for continuing to push and continuing to push our program people to make sure that we get the best plane that we need. That is what we all want.

So I just have a couple of questions, gentlemen. The first one has to do with something that the chairman brought up before I got into the hearing, and this is the whole issue of the 136-pound weight limitation. I have been one of the people on this committee that has pushed for women in more roles in the military, and the gentlelady from Arizona acknowledged that she weighs a lot less than I do, and I—my question is, I am concerned with the long-term weight limitation, and if it disadvantages our female pilots and their eligibility to fly the F-35, because our women do tend to be lower in weight. And so if the 136-pound weight limitation remains in place for more than a few more weeks, how is that going to impact the follow-on on the cadres of the female pilots that we have in the Air Force? And have any of our female pilots already been sort of diverted off of going towards the F-35 because of this weight limitation?

General BOGDAN. Ma'am, I will answer the technical part of that, and let General Harrigian answer the part about specifically about Air Force pilots. We have known fixes to the problems that currently restrict the pilot population to less than 136 pounds. They include a lighter helmet; they include a weight switch on the seat; and they include a pad on the back of the risers of the parachute that prevent anybody's neck from moving forward or aft too much. All those solutions should be in place within the next 12 to 18 months. And at that point in time, the restriction should be removed, and we will go down to 103-pound pilot, as well as the size of the pilot is not an issue, but we design the seat for the smallest and the lightest folks.

So I think you will find that in the next 18 months or so we will make this ejection seat as safe as we possibly can for the entire population.

I will let General Harrigian talk about the pilot throughput and female pilots.

General HARRIGIAN. Thanks, ma'am. So we had one pilot that was less than 136 pounds. In fact, it was a male. So he is no longer flying the F-35. And due to where he was in his career, his leadership decided it is best we move him to another airplane so he can continue his career. We have a female that is flying the airplane right now. She is still flying the airplane right now. But to your point, I think that the longer term is, we didn't have anybody in the pipeline right now that was impacted. But certainly, if this takes 12 to 18 months, there may be a person or persons out there that it could impact. And so that is something we are going to have to take a look at. As you are well aware, the Secretary and the Chief have made it clear that 103 pounds to 245 is our requirement. And General Bogdan knows that that is where we need to go. And he is working very hard to meet that requirement as quickly as he can.

Ms. SANCHEZ. Great. Let's hope we fix it in the next few weeks. Because I would hate for that to be the reason for our women to not be able to move forward—

General BOGDAN. Congresswoman, can I make one other—

Ms. SANCHEZ [continuing]. With what is our next real generation plane for the next 20 or 30 years. Yes?

General BOGDAN. Can I make one other comment? We have partners and FMS customers in the program that are equally concerned about this problem, because much of their population of pilots, whether they be male or female, are on the lower end of the scale. And so I have heard from many partners, many FMS customers, as well as the Air Force, Navy, and the Marine Corps about how important this is to fix. And it has my full attention, ma'am.

Ms. SANCHEZ. Great. Thank you, General. My last question is about the follow-on development for the F-35. And so while the initial engineering, manufacturing, and development stage of the F-35 program is supposedly going to be wrapping up in the next 2 years, there is another, more potentially and very expensive follow-on development that we already have slated for the future of this program. And the follow-on effort is mostly software upgrades that I can tell as I read through everything. It is mostly software upgrades to incorporate additional weapons and electronic capability into the aircraft. But even though it is just an upgrade effort, the budget is not small. I mean, when I look at it, through 2020, I see more than \$2.6 billion in research and development on that effort projected.

And to be clear, that is on top of the baseline F-35 development effort that has seen years of delay and cost overruns. And I don't want to go over all of that because you have heard me pounce on that for a long time now.

I know that these further upgrades are essential. But I think it is important for us to try to get a handle on this before it gets out, gets out of whack as we have seen initially this project from the very beginning.

So I have some specific questions about the follow-on effort. First, before the program starts, this major effort, it obviously

needs a clear set of prioritized requirements from the U.S. military services and from our foreign partners that are involved in this. And so does the F-35 program have a prioritized list from the U.S. military services with respect to what it really wants in the follow-on development? And if not, why not?

General BOGDAN. Yes, ma'am. You have boiled this down to the essence of one of the issues with follow-on development today. With 14 different customers, we have a large amount of requirements that I, today, believe are unaffordable. So as we validate the CDD [capability development document], the capability document, through the Air Force Requirements Oversight Council [AFROC] and then up to the Joint Requirements Oversight Council [JROC], and I go to what I call my board of directors for the partners, we have asked them to prioritize that list of requirements. Because today, I believe that trying to achieve all those requirements in the next 8 to 10 years will be unaffordable.

So the process has begun. We believe in December we will get our first look at that set of priorities. And then in the springtime, when the AFROC and the JROC meet to validate the requirements, I believe that is where we will finally join all of this together to get what I would consider to be a reasonable amount of requirements that are affordable. Because I do not disagree with you, ma'am. I have learned a lot of lessons in 3 years on what the original EMD [engineering and manufacturing development] program looked like. I don't want the follow-on program to look anything like that,

Ms. SANCHEZ. Because the follow-on, as you know, I mean, we have really gone through very painful, on both sides, very painful, this has been a painful process. And that is a nice word for it. So this development and what everybody wants and how it interacts and what it gets I think is incredibly important to have that priority list. So I will look forward to that in December 2015. And I will look forward to it after your capability document validation.

Second, you know, in other similar upgrade programs, Congress has required the DOD to designate them as major subprograms or completely separate programs actually. And the reason for that has been so that we can actually see the cost visibility and we can actually track what is going on. So should Congress do the same thing with this follow-on effort for the F-35? And if not, why not?

General BOGDAN. The simple answer is no, ma'am. And I will tell you why not. So first, my pledge to this committee and to the other defense committees and to my partners and to the services is we will set up the follow-on modernization program with every level of visibility and transparency that you and they believe they need for that appropriate oversight. We will put the earned value management pieces in there. We will cost separate in the contracts so you can see how we are spending the money. But to make this a separate program, or even to make it a separate program brings a whole host of administrative burdens that Mr. Kendall wants to try and avoid to become more agile in terms of acquisition.

I agree with him. I think we can set up a program that satisfies the needs of everyone in terms of transparency and understanding when the program is on track and not on track without designating it as its own program. My promise to the committees is if you don't

believe when we get our acquisition strategy in place, that you don't like that, then we will come and talk to you and figure out what you do like. I have asked your staffs to help us in what you would like to see in that modernization program in terms of reporting. Because we can do that. We can do that without setting up a separate program.

Ms. SANCHEZ. Well, we will have to talk to our staff and see, you know, what we will look at. Maybe a program, a separate line might be required if we are really going to track this. I just have the scars from the initial program, even before the 3 years you have been in. So thank you very much for your information. We will try to work with you. Thank you. Mr. Chairman, thank you.

General HARRIGAN. Mr. Chairman, if I could just add to that. As the warfighter, ma'am, understanding the programmatic and the importance of ensuring we have got our prioritized requirements, which we are working hard as a service with the other services to make sure we have got it right. I think it is important to remember that the threat is not sitting on their hands. And they continue to evolve. So from our perspective, it is imperative that we have a stabilized, thoughtful, follow-on modernization program that brings new capabilities to this airplane so we stay ahead of the curve. And, ma'am, that is all I would like to ensure that the committee remembers as we work our way through this. Thank you.

Mr. TURNER. Mr. Veasey.

Mr. VEASEY. Thank you, Mr. Chairman. I wanted to ask you about the helmet, too. I know that you want to make changes to the helmet so it is more compatible for all the pilots in the Air Force. I know that that is going to be a really big priority for you. But I wanted to ask you about the HMDS [Helmet Mounted Display System], because I know that is a big part of what makes the F-35 special is the helmet itself, and that there has been a lot of technology put into it. And one of the things that we have heard in previous hearings that we have had on sequester was that being able to implement new technology under a sequester system can be tough. So knowing that we are working under the sequester, how quickly can changes be made to the helmet?

General BOGDAN. The changes and the improvements that we are making to the helmet, Congressman, are part of the broader SDD [system development and demonstration] program. And because our SDD program is incrementally funded, even with a CR [continuing resolution] or a sequestration, we would still be able to continue those critical development activities like the helmet. We would ensure that those kind of things are not impacted. There are many other things that would be impacted. But in this respect, finishing the development program and creating the capability that we promised the warfighter is our number one priority. And I think we can do that. There is many other impacts, but not that one.

Mr. VEASEY. And one more question about the helmet itself. Again, I know just the incredible technology that has gone into developing the helmet and, again, being able to make quick changes to that helmet so everyone can fly, is it more realistic to make changes to, like, the head support panel or delaying the deployment of the parachute in order to make it to where all the pilots

can fly the plane instead of actually trying to make very complicated technology changes to the helmet?

General BOGDAN. Congressman, the simple answer to your question is no. We need a lighter helmet. It is as simple as that. All the other things that you talked about are also needed to ensure that we have safe escape for the whole pilot population. But we do have to take weight out of the helmet. The one point I would like to make about taking weight out of the helmet is we are not changing any of the electronics. We are not changing any of the sensors in the helmet. To remove the 6 ounces that we need from the helmet to get it under weight, what we are doing is we are taking the material that is used for the strapping and for the cushioning of the helmet and changing that material to something lighter and stronger.

And the second thing that we are doing is today's helmet has a dual visor on it, a daytime visor and a nighttime visor. We are going to remove the double visor and put a simply daytime visor on it such that if the pilot needs to change to the nighttime visor, just like our legacy airplanes, he or she will reach into their pocket and they will take the daytime visor off and put the nighttime visor on. Those two are fairly simple things to do. Now, I never want to say anything is easy in the F-35 program because nothing is ever easy. But in this instance here, I think we got it just about right. Because we are not going to mess with any of the high-technology things that make that helmet what it is.

Mr. VEASEY. Thank you. Mr. Chairman, thank you very much.

Mr. TURNER. Ms. Graham.

Ms. GRAHAM. Thank you, Mr. Chairman. Thank you both for your service. Thank you for being here. As a north Floridian, both Eglin and Tyndall, incredibly important. And your service and the service of so many men and women who live in north Florida is greatly appreciated. So thank you. When we had a CODEL [congressional delegation]—and, Mr. Chairman, when did we go on that CODEL? When was it? In March?

Mr. TURNER. In March.

Ms. GRAHAM. And it was so informative and really impressed with the F-35. There was one area that, though, there was consistent concern both with the pilots and with the maintenance, those that maintain the airplanes. And I am not going to use an acronym because I have learned to not use acronyms. But it has got a snappy one. But it is Autonomic Logistics Information System, aka ALIS. So there were real concerns about false, you know, errors reporting. And I am just curious, have we resolved some of the software issues that ALIS was facing? Thank you so much.

General BOGDAN. I will give you the technical answer. And I will let General Harrigan give you the warfighter's perspective. So since your visit down there, we took a look at that health reporting code problem. And we have done a number of things since then that have improved the situation. The first thing we did was we put a new increment of software and capability into the ALIS system. We call it ALIS 2.01. That fixed some of the problem.

Another part of the problem was that we did not have a complete list of those codes that were false, so to speak, at the time. And we were worried that if we made the list too big, that a code that

really wasn't false would get overlooked. We have a lot more time on the airplane now and a lot more maturity on the airplane. So we were able to upgrade that list. The bottom line here is the 80 percent number that you heard down at Eglin, which was accurate, for the entire fleet today is about half that now.

That is not the best part of the story. Because that is the whole fleet. The best part of the story is that Lot 6 and Lot 7 airplanes that we are fielding today, because they have many of the R&M [repair and maintenance] improvements that we made over the last 2 years, they are only seeing a very small handful, like 1's and 2's, when they land each and every day. So that 40 percent now that used to be 80 percent includes all the older airplanes that until they are upgraded, that they are still going to have that issue. But the newer airplanes, much better. General Harrigian has some experience with the new Lot 7 airplanes at Hill Air Force Base that they have been using. And he might be able to tell you a little more.

General HARRIGIAN. So those airplanes, ma'am, we have three of them up there. And they have not lost a sortie since they delivered them. So as we have delivered these newer airplanes, they are performing really, really well. And Eglin still has some of the older ones, so they struggle with some of the older systems that the Program Office has continued to update over time, even since last March, as General Bogdan points out, so that it continues to improve.

Now, having said that, there is still going to be challenges as we understand ALIS and put our maintainers in the field working through that system with the Program Office. And I will tell you one of the things that we did is we had our senior logistic leaders from all the F-35 bases and folks from the JPO coming together to talk about what are the big issues. This, of course, was one of them. And so we provided a list of some specific things, this fault reporting code issue being one of them, that we have worked very closely with the Program Office to get the feedback from our airmen in the field, and get those to the Program Office so they can work through, prioritize those, and get after the most important issues to ensure we are fixing the right things on the airplane.

Ms. GRAHAM. Well, that is really great to hear, because I could hear the frustration, that they were faced with all these false negatives that they were having to deal with. You mentioned other airplanes. Are they using the same software system? They are using ALIS?

General BOGDAN. Yes. All the airplanes in the fleet are using ALIS. It is just the newer airplanes have many of the fixes in terms of software and hardware that we learned from the older airplanes. So if you went to Eglin today, what you would find on their flight line is airplanes that are in what we call the Block 1 configuration, believe it or not, and the 2A configuration. When those airplanes get upgraded to the 2B configuration or the Block 3 configuration like we have at Hill or at Nellis, you are going to find a lot of those problems have gone away. We just haven't had time to backfit and modify those older airplanes.

Ms. GRAHAM. Great. And my time has expired. But thank you very much. A good, positive update. Thank you.

Mr. TURNER. Ms. Speier.

Ms. SPEIER. Mr. Chairman, thank you for the accommodation. And thank you, Generals, for your presentation and for your service. I wanted to be clear, did you say in your opening testimony that you have accepted, you have received 79 F-35s to date?

General HARRIGIAN. Yes, ma'am. In the Air Force, we have.

Ms. SPEIER. So with the 79 that you have received, do they all have this ejection seat issue?

General HARRIGIAN. Yes, ma'am. Every airplane.

Ms. SPEIER. Now, I understand that you tested the ejection seat on lighter—on a mannequin that was 135 pounds. I have also understood that more recently, you have tested it on a 245-pound mannequin. But it has not been tested on a mannequin between the weight of 135 and 245, is that correct?

General BOGDAN. In the development test program, we do have those test points planned out. But you are correct, as of today, we have done the high end and the low end.

Ms. SPEIER. So my concern is this: If we know there is a problem on the low end, we haven't tested it for those who are likely to be most pilots between the weight of 135 and 245, and we have them in these planes now testing them, are we putting any of them at risk?

General BOGDAN. The answer to that is no, ma'am. Because we have done the risk analysis on the test points that we have had on the ejection seat. And what we have found is the only area where we have a problem today is with the lightweight pilot below 136 pounds. Because when we have tested throughout the envelope, you can't test every point for every weight, but the areas that we have tested indicate that in the heart of the envelope for the heart of the pilot population, there is not any increased risk of injury at all. And I can show you that analysis, ma'am.

Ms. SPEIER. All right. Thank you.

General HARRIGIAN. Ma'am, from the service perspective, we have a Life Cycle Management Center that is part of our airworthiness organization. And they have—and, ma'am, to be clear, I have talked with the guys who have been working this for 30 years, because clearly, this is an important issue for us. And we share and talk very closely with the Program Office with this. And exactly what General Bogdan said is how it was communicated to us. In fact, they have shown us the chart, how it lays out, and what the risk levels are. And so, as General Bogdan said, there is certain risk there. We have accepted it, accept that the low end beneath 136 pounds.

Ms. SPEIER. Well, there has been some report that there has been a memo that you accepted, General Bogdan, that, accepted a 1-in-4 risk of death, with—a problem with the ejection system as being a risk that is worth taking I guess. Is that correct?

General BOGDAN. Ma'am, that is incorrect. The data that you have came from a reporter who got a copy of an official use only, internal DOD document that my team put together to assess the risks of a lightweight pilot and a pilot between 136 and 165 pounds. That document should have never been publicly released. I have an investigation ongoing to figure out how that reporter got

it. But the worst part of this is, the reporter did not know how to read the report, ma'am. So let me give you the actual facts.

Today, a pilot that weighs less than 136 pounds, if he steps to the airplane, he or she has a 1-in-50,000 chance of hurting their neck from an ejection. A pilot between 136 pounds and 165 pounds has a 1-in-200,000 probability of having neck injury from ejection. The individual who reported on this is not an expert in system safety.

Ms. SPEIER. Okay. My time is running out. As I understand it, the test was done under ideal circumstances. Is there any reason to feel that the results would be any different in circumstances where it was going not at ideal speeds, but—and not going straight but going up?

Mr. TURNER. Your time has expired. Generals, I want to thank you for being here. You have continued to provide the information as required by this committee. And we will continue to hold this program accountable and provide oversight, not just because there are issues or problems that have arisen, which there are, but because this program is so incredibly important. It needs to be safe for our pilots. It needs to be safe for our country. And it needs to be able to perform at the level it has been asked to perform, because the gap that this plane is going to fill is incredibly important. With that, I thank you both for your service. And I know that you both know that we will continue to work both through the committee hearing structure and throughout the calendar year to both inquire and to work with you to ensure this plane can deliver. Thank you.

[Whereupon, at 4:55 p.m., the subcommittee was adjourned.]

A P P E N D I X

OCTOBER 21, 2015

PREPARED STATEMENTS SUBMITTED FOR THE RECORD

OCTOBER 21, 2015

**Statement of the Honorable Michael Turner
Chairman, Subcommittee on Tactical Air and Land Forces
Hearing on Update on the F-35 Joint Strike Fighter Program
October 21, 2015**

The hearing will come to order.

The subcommittee meets today in open session to receive testimony on the current status of the F-35 Joint Strike Fighter (JSF) program.

I'd like to welcome our witnesses:

- **Lieutenant General Christopher C. Bogdan**, F-35 Program Executive Officer, and
- **Major General Jeffery L. Harrigian**, Director of the Air Force F-35 Integration Office.

Thank you both for your service and we look forward to your testimony today.

This hearing continues the committee's ongoing oversight of the F-35 program since the program officially began in 2001.

We all know the F-35 is a complex program that has experienced issues with cost, schedule and performance through its development.

This subcommittee has held numerous hearings and briefings to better understand the critical need for 5th generation strike fighter capability and to understand the issues facing the program.

Most recently the subcommittee visited Eglin Air Force Base in March where we were able to meet with both pilots and maintenance personnel for the JSF.

It's through this ongoing Committee oversight that we have identified issues relating to the program and in turn we have worked with the Department to help develop corrective actions to ensure the program remains on track.

For example:

In fiscal year 2014, the subcommittee learned of software development problems and recommended legislation that would establish a team to review the F-35's software development program and make recommendations to fix these problems.

For fiscal year 2015, the committee recommended legislation that would continue the Government Accountability Office (GAO) assessments and analysis of the development, testing and production of F-35 aircraft.

During our visit at Eglin Air Force Base, the Subcommittee learned of issues with the F-35 the maintenance system known as the autonomic logistics information system or “ALIS”.

As a result, the subcommittee included a provision in its mark of the National Defense Authorization Act for fiscal year 2016 that would require the GAO to review the ALIS and provide a report to the congressional defense committees by April 1, 2016.

The committee also recommended a provision that would require a review of the F-35’s engine program by a federally-funded research and development center to ensure that future engines will not be subject to the failure that caused an F-35 engine fire on take-off a year ago last June.

Each of the subcommittee’s legislative recommendations over the past three years have been adopted in the annual National Defense Authorization Acts.

Over the past month, the subcommittee has learned that the ejection seat does not meet the design specifications for lighter weight pilots. The specification for the ejection seat is that it needs to be able to accommodate a safe escape at pilot weights of 103 to 245 pounds. We understand that until this deficiency is corrected, pilots weighing less than 136 pounds will not fly the F-35 due to a higher risk of serious injury that could result from having to eject. We expect to hear from our witnesses on how they plan to get this problem corrected.

In closing, while strong oversight of the F-35 remains necessary I find the value of a fifth generation stealth aircraft like the F-35 in future conflicts to be absolutely critical to successfully address emerging threats and maintaining air dominance in any overseas contingency operation.

I look forward to our witness’ testimony today and expect to gain a better understanding of the follow-up actions currently being taken to address the issues identified as a result of our delegation visit to Eglin.

Before we begin, I would like to turn to my good friend and colleague from California, Ms. Loretta Sanchez, for any comments she may want to make.

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THE HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES

DEPARTMENT OF DEFENSE

WRITTEN TESTIMONY FOR THE
HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON
TACTICAL AIR AND LAND FORCES
UNITED STATES HOUSE OF REPRESENTATIVES

SUBJECT: F-35 Lightning II Program Update

WITNESS STATEMENT OF: Lieutenant General Christopher C. Bogdan, USAF
Program Executive Officer, F-35

October 21, 2015

NOT FOR PUBLICATION UNTIL RELEASED BY
THE HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES

I. Introduction

Chairman Turner, Ranking Member Sanchez and distinguished Members of the Committee. Thank you for the opportunity to address this committee regarding the F-35 Lightning II.

The F-35 Lightning II Joint Program Office is the Department of Defense's largest acquisition program, and it is of vital importance to our Nation's security. The F-35 will form the backbone of U.S. air combat superiority for decades to come. It will replace the legacy tactical fighter fleets of the Air Force, Navy, and Marine Corps with a dominant, multirole, fifth-generation aircraft, capable of projecting U.S. power and deterring potential adversaries. For our International Partners and Foreign Military Sales (FMS) customers, who are participating in the program, the F-35 will become a linchpin for future coalition operations and will help to close a crucial capability gap that will enhance the strength of our security alliances.

II. Accomplishments

In the months since this committee last heard from the Program Office, the F-35 team has had numerous accomplishments. There is nothing more rewarding than to see the F-35 in the hands of the warfighter. The United States Marine Corps' announcement this summer that it had achieved an Initial Operating Capability (IOC) with the F-35B was an excellent first step in operationalizing the F-35. For the first time, our Combatant Commanders will now have a 5th generation strike fighter capable of operations from expeditionary airstrips or sea-based carriers. The F-35 team is committed to expanding and sustaining this capability.

There were numerous accomplishments in flight testing in recent months, most notably, completion of F-35B Block 2B Operational Test aboard the USS WASP and early successful

completion of the second round of development tests with F-35C aboard the USS EISENHOWER. The F-35A completed ground test firings of its internal GAU-22 25-millimeter cannon and airborne functionality testing is now underway earlier than planned with F-35A air-to-ground accuracy testing which was originally scheduled next summer. In addition to those items mentioned above, below is a list of accomplishments also achieved during the year. In this hearing I intend on providing a fact based assessment of both the good and the bad on the program so you can form your own judgments as to the program's progress.

- Began Block 3F testing
- Completed all Block 2 testing with the exception of a single A-model fuel fix
- Successful completion of F-35B Operational Test 1 aboard the USS WASP
- First successful operational fleet (VMFA-121 Yuma) weapons drops
- Successfully completed all Block 3i weapons delivery accuracy events
- Successfully completed F-35C Development Test 2 aboard the USS EISENHOWER
- Delivered first LRIP 7 aircraft
- Installed two Full Mission Simulators in the F-35 simulation facility
- Released Block 2B software for training
- Started Air Force and Partner pilot training at Luke Air Force Base
- Declared Marine Corps Initial Operational Capability
- Delivered first F-35A to Hill Air Force Base
- Delivered United Kingdom and The Netherlands' aircraft to Edwards Air Force Base for Operational Test
- Rolled out first F-35A from the Italian Final Assembly and Check Out facility
- Conducted First Flight of Italian-built F-35A
- Completed Italian tanker flight testing
- Conducted first Turkey and Norway site activation team visits

While these accomplishments are good news it does not mean that we are without current challenges and risks which we are addressing each and every day.

III. Progress in addressing 33rd Fighter Wing issues:

On March 27, 2015 a Tactical Air and Land Forces Congressional Delegation visited Eglin Air Force Base in Florida to discuss the F-35 program and current state of training

operations. There were numerous pilot and maintenance issues identified during the visit related to the F-35 air combat system. These issues and our comments follow:

1. Contractor's scale of control due to Autonomic Logistic Information System

(ALIS). The program continues working hard with the services to identify those processes that can be transferred to organic maintenance, and in the future intends to transfer to organic maintenance many of the things industry currently performs. For example, the US Marine Corps is transitioning ALIS administration from industry to organic manpower, and the Department is currently putting in place plans to duplicate and place the ALIS network and hardware on to US Government owned and operated facilities.

The Program is also expanding the use of DoD program office personnel in the field as part of our growing Lightning Support Team, replacing industry field service representatives. We are also expanding many of the repairs currently being performed by industry with both our Depots and local maintenance units.

2. Accuracy of parts status. JPO continues to develop strategy to ensure global Total Asset Visibility (TAV) through contractor-based System Application Products (SAP) systems, ALIS, US Gov't Accountable Property System of Record (APSR), and other supporting inventory managements system to achieve total asset visibility. As part of the F-35 asset management strategy, Lockheed Martin was tasked by the JPO to develop tools that would link parts supply chain information from the end-user (warfighter) all the way back to the vendors so parts orders could be tracked from beginning to end and provide accurate unit counts, delivery dates, and parts status. The program continues to engage with Lockheed

Martin in pursuit of asset management solution that will leverage Lockheed Martin data management systems.

3. Supply Chain Concerns. The program continues to address issues that have resulted in shortfalls of inventory at the sites. We have addressed this problem aggressively by pursuing additional Service funding and the use of a new forecasting tool which predicts material availability several years in advance and continually adjusts data with revised engineering estimates and flight line usage numbers, thereby improving safety stock. We are also improving the timing for purchasing spares: all LRIP 9 spares contract were awarded during fiscal year 2015, within the first year of budget execution; LRIP 10 spares contracts actions are scheduled as soon as fiscal year 2016 funding is available; and the LRIP 11 spares listing have been completed for further contracts actions. In 2015, there has been a steady upward trend for repairable stock levels.

4. ALIS False Positive Concerns. The F-35 air system is experiencing fewer “false” Health Reporting Codes (HRCs) generated by the aircraft. The problem was more severe with our earlier software versions (Block 1B and Block 2A) which are being used at Eglin Air Force Base. The release of Block 2B software has resulted in an improvement cutting these false codes over earlier Block 1B/2A versions in half.

5. Lengthy Download Times. Currently the pilot debrief timeline is too long as it takes approximately 1.5 hours to download a 1.5 hour flight. This is unacceptable and the Program Office and Industry are in the process of fielding an improved system. The new Ground Data Security Assembly Receptacle System (GDR) will decrease the timeline to download mission data by a factor of 8, meaning a 1.5 hour flight will be downloaded in

about fifteen minutes. The new system successfully completed a Critical Design Review in September 2015. Developmental units are now being built for qualification and integration testing. We will deliver the new GDR in July 2016 with the first 10 units delivered to the US Air Force to meet its August 2016 Initial Operational Capability (IOC). Further GDR deliveries to back-fill other units will begin in fall 2016.

6. Flight Gear not Comfortable or Practical. F-35 pilot flight equipment (PFE) is integrated with the ejection seat arm restraint system, which limits mobility. The JPO shares this concern and is actively looking for alternatives to include alternate flight gear. With the help of the Aeromedical community, the JPO is pursuing the implementation of an improved capability for in-flight relief without pilots having to unbuckle the seat restraint harness.

7. Seat Configuration. The design of the F-35 is optimized for 21st century warfare long-range see, shoot, kill tactics rather than close-in dogfighting. No change to the rear visibility of the jet will be possible without reducing the one thing that makes the F-35 so survivable – stealth. The pilot community is currently developing tactics and CONOPS to deal with this visibility limitation and should not detract from its survivability or mission accomplishment.

8. Block 3i Limitations. The capabilities delivered in Blocks 2B/3i are indeed limited – that was how the program was designed. The decision as to whether these limited capabilities are good enough for declaration of IOC is purely a U.S. Air Force decision. The JPO believes the 2B/3i capabilities provide the warfighter with ample combat capability and survivability in some – but not all – combat situations. The final Block 3F in late 2017 will

deliver many more weapons and capabilities. The JPO is prepared to brief the committee in depth on both the unclassified and classified capabilities of Block 2B/3i.

9. Software Fix Cycle Time Too Long. Fixing software deficiencies is a complicated and sometimes time-consuming task. Anytime software in the aircraft is changed, many things must happen before the new software and capability can be delivered to the warfighter. Having said that, the JPO and Lockheed Martin have re-engineered our software processing to significantly reduce the time it takes to design, test and field limited software fixes. In the past this cycle took three months; today the JPO and Lockheed Martin have reduced this cycle time (from fix, to lab test, to flight test) to about one month. Additionally, working with the US Navy and Air Force Systems Commands we now have the ability to deliver new versions of software to the Operational Test community within approximately 45 days from release to Development Testers. This early release will provide advance feedback on deficiencies and software issues so they can be corrected in a much shorter timeframe.

10. Gun Aiming System Quality. The three F-35 variants are in various phases of testing the internal gun (F-35A) and external gun pod (F-35B/C). The F-35A gun system ground testing is complete with test firings of 10, 15, 30, 60, 90, 120, and 181 rounds. Gun accuracy, measured during the ground testing, is performing better than the required specification. Effectiveness testing of the combat ammunition is ongoing, and when combined with the measured accuracy, should show favorable comparisons to most legacy aircraft. Airborne gun functionality testing is now underway earlier than planned with F-35A air-to-ground accuracy testing which was initially scheduled for August 2016.

11. Electro-Optical Targeting System (EOTS) limitation compared to external targeting pods, especially for Close Air Support (CAS). The F-35 has significant growth potential and at the end of Development (end of CY2017) the Program will begin its Follow-on Modernization work which will include upgrades and technology insertion of its sensors. The F-35's EOTS current performance requirements were established as part of the development baseline in the mid-2000s. Meanwhile, development in external targeting pod capabilities has continued to progress, while F-35 has worked to integrate EOTS based on its original design and unique requirement set. The F-35 will deliver warfighting capability that meets the warfighter's needs that were established in the early years of the program. This means that in some instances the current F-35 EOTS will not have the same capability that exists in currently fielded / upgraded platforms that have benefitted from technology upgrades over the past decade. Improving EOTS to leverage the newer technology that has been developed over the last 10 years is a high priority in Follow-on Modernization (Block 4).

12. Old weapons on 5th gen aircraft; Newer, better weapons won't be usable at IOC. The weapons planned for release with Block 2B in 2015 and Block 3F in 2017 are expected to meet Service requirements. Newer weapons such as GBU-38/54 (500 LJDAM/JDAM) and SDB-II (GBU-53) are planned for integration on the F-35 beginning with Follow-on Development in the 2019-2021 timeframe.

13. IOC with only two air-to-air weapons, not four. It is true that in Block 2B/3i the aircraft will be capable of only two AMRAAMs carried internally--but again this is a limited capability that will be improved with the full Block 3F capability in late 2017. With Block

3F the internal AMRAAM capability will double to four. Post SDD, the authorized AMRAAM Loadouts can be increased to the maximum aircraft capability of 12 missiles, carried both internally and externally.

14. MADL is not compatible with IFDL (F-22) datalink. The U.S. Air Force has not identified a requirement for MADL/IFDL compatibility--current information sharing between the F-35 and F-22 is accomplished via Link-16. While improved F-35/F-22 datalink compatibility approaches are being investigated by numerous companies under Independent Research and Development, there is no formal Program of Record effort to integrate MADL and IFDL on either aircraft yet. The JPO believes such capability, if it were to become a requirement, could be developed in Block 4 Follow-on Development.

IV. Progress toward Air Force and Navy Initial Operational Capability (IOC) dates.

The U.S. Navy has set August 2018 as its Initial Operational Capability date with the F-35C. In support of meeting the U.S. Navy IOC, the F-35C recently successfully completed its second of three sea trials and provides the U.S. Navy a highly useful carrier launch and recovery envelope for operationally representative internal store configurations that the training squadron, VFA-101, will begin using next year to train. We had no significant deficiencies or issues with this second sea trial and the aircraft and crew, as well as the test team, performed magnificently. The remaining sea trials next year will round out the aircraft carrier flight envelope by enabling launch and recovery with external stores.

U.S. Air Force IOC with Block 3i capabilities is planned between August and December 2016. The F-35 Lightning II Joint Program Office's number one priority is meeting Air Force IOC in August 2016. Hill's active-duty 388th Fighter Wing and Reserve 419th Fighter Wing

will be the first Air Force combat-coded units to fly and maintain the Lightning II. In support of meeting the Air Force's IOC date, Hill Air Force Base in Utah has already received the first three F-35As. A minimum of twelve F-35s are required to declare IOC and current aircraft delivery plans support this requirement. Overall, we are closely tracking US Air Force IOC for August 2016, although there are a number of risks must be mitigated to meet this date.

- **ALIS:** We are currently developing the next version of ALIS, version 2.0.2, which includes new capabilities to support Air Force IOC. This version combines the management of F135 engine maintenance within ALIS and tracks all the life-limited parts on each and every F-35 aircraft. It also provides ALIS connectivity between 2 or more squadrons and will allow a squadron to deploy to multiple sites at the same time. ALIS 2.0.2 is planned to complete development by the end of November 2015 bringing all these new capabilities into the integration and test phase. Working groups with representation from the U.S. Services and Partner countries are finalizing comprehensive test plans for initial testing in January 2016 leading to formal system security testing in early May 2016. However, there is schedule pressure that we are monitoring very closely and attempting to mitigate to meet the objective US Air Force IOC date of 1 August 2016 with ALIS 2.0.2. I believe there is at least 30-60 days of risk in meeting the ALIS ready to field date needed for US Air Force IOC.

- **Modifications and impact to training:** The Air Force IOC aircraft at Hill Air Force Base will need modifications to bring them to full Block 3i configuration to provide the full Block 3i aircraft operating envelope, and adding airborne lightning protection and weapons employment capabilities. These modification requirements and their associated down times

add risk to the IOC date because the down times for modifying these aircraft removes them from the flightline and reduces the number of aircraft for pilot training. We are working with the US Air Force to find solutions to the aircraft shortfall

- **Mission Data File:** The U.S. Reprogramming Lab (USRL) at Eglin Air Force Base is tasked with delivering four different Areas of Responsibilities (AOR) Mission Data File (MDF) loads for specific geographic regions of the world. MDF loads enable the aircraft's sensors to identify and categorize threat radio frequency emissions. As of October 1, 2015, the lab is on track to provide three of the four required AORs prior to the Air Force IOC objective date of August 1, 2016, with the final Mission Data File to be delivered in September, 2016.

V. Cost, Schedule, and Performance Metrics and Production Status:

The price of F-35s continues to decline steadily Lot after Lot. For example, the price (including airframe, engine, and profit) of an LRIP 8 aircraft was approximately 3.6% less than an LRIP 7 aircraft, and an LRIP 7 aircraft was 4.2% lower than an LRIP 6 aircraft. Both LRIP Lots 9 and 10 airframe and engine contract negotiations are nearing completion and contract award is anticipated later this year for LRIP Lot 9, and once the DoD Budget is authorized and appropriated, we will be ready to award the LRIP Lot 10 contract sometime at the beginning of the new year.

The program is on track to meet its 2015 production goal of delivering 45 aircraft to our customers. Forty-four (44) of those aircraft are being produced in Fort Worth, Texas, and the Italian Final Assembly and Check Out facility at Cameri, Italy is on track to deliver its first Italian F-35A by the end of the year. As of October 2, 2015, thirty-two (32) LRIP Lots 6 and 7

aircraft have been delivered to our test, operational and training sites. Sell-off (DD-250) of LRIP Lot 6 aircraft ran 68 manufacturing days behind the contracted dates but we have seen a 42-day improvement with the Lot 7 aircraft. We continue to work with Lockheed Martin and Pratt & Whitney, as well as the supply base to ready the program for the production ramp increase over the next few years.

Through the calendar year, aircraft deliveries are tracking our initial forecast and the numbers of hours required to build the aircraft is declining. Additionally, the quality in each delivered aircraft is improving. This begins with establishing the appropriate contractual requirements and program plans, ensuring contractor flow-down to its supply chain, and monitoring execution through robust performance metrics. The program continues to collaborate with the Defense Contracts Management Agency, the Defense Contract Audit Agency, and the prime contractors to influence improvement initiatives, ensure process discipline, attention to detail and adherence to established and robust procedures yielding a continually improving and more capable aircraft delivered to our U.S. and international customers.

The supply chain is a critical element to the F-35 production and accounts for 74 percent of the program cost. Lockheed Martin continues to work closely with the supply base to address issues impacting on-time delivery and quality performance. Year to date improvements have been seen in material availability reducing shortages by 50 percent. Despite these reductions, critical part shortages continue to cause out of sequence work and production inefficiencies. Corrective action plans have been identified and implemented and are being monitored by the program office. Lockheed Martin continues to refine its supply chain's readiness to transition to higher production rates through its annual Production Readiness Review (PRR) process. The

JPO continues to identify improved performance metrics to gain additional insight into the prime contractor's ability to proactively manage its supply chain. The JPO is working with the prime contractor to further refine the PRR process. Mitigation plans for current supplier performance issues and production readiness risks have been identified and are actively managed.

The Program is exploring the possibility of entering into a Block Buy Contract (BBC) with Lockheed Martin Aero and Pratt & Whitney to procure 465 F-35 aircraft over Lots 12-14. The advantage of a BBC approach includes substantial cost savings, stability for the supply chain, and reduction in administrative burden and costs.

The Department is committed to working with Congress to get approval for the Block Buy Contract during the fiscal year 2017 Budget deliberations for a fiscal year 2017 Economic Order Quarterly (EOQ) procurement action followed by a fiscal year 2018 Block Buy contract award. The F-35 JPO has put the RAND Corporation, a Federally Funded Research Development Center, on contract for an independent savings assessment, and a final out-brief of the results of this study are due in March 2016.

This year has seen the propulsion program respond to quality and reliability issues that were affecting production deliveries and sustainment. Reliability improvements that started during the 2010 re-baselining have been introduced into production and we are working to improve further. Quality issues have reduced and production deliveries recovered to or ahead of contract delivery dates by late summer. Production deliveries this fall are about a month behind due to growing pains with Pratt & Whitney's planned transition to a commercial parts kitting warehouse, but are expected to recover by year's end.

Beyond production, one of the major areas of concern with maintenance and sustainment

over the past 18 months has been the availability of aircraft. The metrics used to measure this are called Aircraft Availability and Mission Capable rates. Aircraft availability is a measure, in percentage, of how many aircraft are available in the hands of the warfighter on any given day – meaning they are not in maintenance or being modified. Mission capable rate is the percentage of available aircraft that are capable of flying particular missions, having passed all their pre-flight maintenance and pilot checks. Typical aircraft availability rates for mature aircraft range from 60 to 75 percent, and typical mission capable rates for mature aircraft range from 70 to 80 percent. In 2013, these measures were not good; for F-35 Aircraft Availability was around 35 percent and Mission Capable rates were around 40-45 percent. As a result, in 2014, we began a dedicated Reliability and Maintainability program, along with a focused look at our maintenance procedures known as “Operationalizing the F-35.” These programs incorporated aircraft design improvements, repair improvements on parts that are broken, better maintenance procedures and manuals, and better, more available spare parts. All of this has resulted in steady improvements over the past year and a half. Our focused efforts improved Aircraft Availability and Mission Capable rates late last year, hitting levels of approximately 55 percent and 65 percent, respectively. Although we have more work to do to improve on these metrics, the current set of initiatives seems to have started a positive trend.

VI. Continuing Resolution:

While the F-35 program is able to function under a short term continuing resolution (CR) without driving significant impacts to the program, a long-term CR would be detrimental to the F-35 production ramp-up and drive increased costs for the United States and our International Partners. It would restrict the government's ability to award the full quantity of U.S. F-35 aircraft

to be procured in the LRIP Lot 10 contract until the 2016 defense budget is approved. Should the program operate at fiscal year 2015 budget levels, for a long period of time the Department would be unable to provide 16 F-35As for the U.S. Air Force and 3 F-35Bs for the U.S. Marine Corps. If the Department is unable to procure these 19 aircraft on the Lot 10 contract, alternate contracting arrangements will have to be made, potentially resulting in increased costs for not only the 19 US aircraft but for the other aircraft in Lot 10. A long-term CR would also negatively impacts the program's ability to move forward with early planning of F-35 Follow-on Modernization which is the next phase of the program once SDD ends in October 2017. Up to a year's delay of Follow-on Modernization Program could result from an extended CR.

VII. Technical Issues:

- **Structural Testing:** As previously reported, in September 2013, during F-35B full-scale durability testing we experienced a significant bulkhead crack at 9,056 Equivalent Flight Hours (EFH), which is 1,056 EFH beyond its first lifetime. The durability testing was stopped on the B-model and a root cause investigation was conducted. Once root causes had been established, redesign efforts for the bulkheads began. A number of locations were identified requiring redesign to meet the intended life, and most were addressed using standard techniques such as material thickening or cold working. However, several bulkhead areas were identified that will need further material improvements to meet the full 8,000 hour life. As part of the material improvements, industry is currently qualifying a process known as laser shock peening (LSP). This method will be available for both production and retrofit of fielded aircraft by the end of 2017. There is no immediate airworthiness concern for fielded or test aircraft because they have thousands of hours of life left before they reach their

interim life limit and then require LSP. Additionally, due to the differences between the bulkhead forging materials of the F-35B (Aluminum) and the F-35A/C (Titanium), we have yet to see the same cracking issues with the A and C-models. Currently the A-model second life durability testing is complete with no major findings. The C-model is currently at 13,000 EFH and expected to be complete with second life durability testing in February 2016. The B-model is approaching 12,000 EFH and expected to complete second life durability testing in July 2016. In addition, the durability tests for the horizontal and vertical stabilizers for the three variants have successfully completed 24,000 EFH or three lifetimes of testing with no significant findings.

- **Software Development:** At this time Block 2B software is in the hands of the warfighter and we have also completed 99 percent of Block 3i testing. We expect the 3i software, which is the Block 2B capability re-hosted on improved hardware, to be in the hands of the warfighter in the spring of 2016.

Block 3i software will allow the aircraft to perform basic Close Air Support (CAS), Interdiction and limited Suppression of Enemy Air Defenses (SEAD)/ Destruction of Enemy Air Defenses (DEAD) operations in a contested environment. Block 3i Mission Systems software has completed Developmental Testing and many of the deficiencies discovered this past spring and summer have been corrected. This software was delivered to the Operational Test community at Nellis Air Force Base on 1 October 2015, significantly sooner than previous software loads. This early look at the final Block 3i software by the Operational Testers will mitigate the risk of meeting US Air Force IOC requirements. Operational testing began flying with the new software last week. The US Air Force sees this software

development as a potential risk for IOC until it has been fully tested and explored by our operational testers; however, development ground testing results note improvement.

The F-35 now has its fleet of six (6) mission systems aircraft in the final SDD Block 3F configuration and although we are slightly behind due to spending more time fixing Block 2B and 3i software, Block 3F developmental testing is moving forward aggressively to recover schedule margin to ensure time to correct deficiencies and deliver on our commitments.

- **F135 Engine:** The program was able to determine root cause for the engine failure, and developed an interim solution: a “pre-trenched” rub material that has been implemented in the field and on the production line. Retrofit of the entire fleet is over forty percent complete and will be completed in spring of next year. Pratt & Whitney has agreed to cover the costs for the repairs to engines in the field and the cut-in of the solution to the production line, while the program office will pay for the design activity as per the development contract. The corrective action team studied several re-design options including the interim pre-trench solution and determined that the pre-trench design was the best performing and most affordable solution for the long term.
- **Safe Escape:** The F-35 escape system was designed to provide safe escape for the widest range of both aircrew weight (103 to 245 pounds) and anthropometry (sizes), well beyond current legacy fighters. The only issue we currently have with the system effects only lightweight pilots (those less than 136 pounds). There is an increased risk of neck injury to these lightweight pilots during the three phases of the escape sequence: Catapult, Wind Blast, and Parachute Opening. The reason there is an increased risk only for lightweight pilots is

because these pilots are assumed to have lower neck strength than heavier pilots and therefore are unable to sustain higher neck loads we are seeing during ejection.

The program is working with our industry partners on three specific improvements that will provide lightweight pilots that same level of protection and safety as all other F-35 pilots. These three improvements are: one, a reduced weight helmet that weighs 6 ounces less than the current helmet that will reduce neck loads during catapult and windblast phases; two, a pilot “weight switch” on the ejection seat that reduces the opening shock of the parachute by slightly delaying the parachute’s opening for lightweight pilots; and three, a head support that will be sewn into the parachute risers that will reduce the rearward head movement of the pilot when the main chute of the ejection seat opens reducing the pilot’s neck loads. The combination of three improvements will provide the needed protection for lightweight pilots.

- **Fuel Over-Pressurization and On-board Gas Generation System:** Two other technical issues we are currently resolving are the potential for structural damage to fuel tanks at increased G-levels and implementation of the aircraft’s ability to inert its fuel tanks for lightning protection. Corrections for all three variants for the fuel tank deficiency have begun. The improved inerting system was recently qualified, and full lightning clearance is expected by the end of 2015. However, due to differences in F-35B and F-35C fuel systems, the new inerting system has not yet been fully qualified for the B or C models. The F-35B will be fixed with software by November 2015 for fielded aircraft and LRIP 8 for production aircraft. The F-35C will be corrected with a hardware change in the 2016-2017 timeframe.

Implementation of both overpressure and lightning corrective actions will occur together to provide full g-envelope and full lightning protection for all three variants.

VIII. Autonomic Logistic Information System:

Overall, ALIS is making slow but steady progress. The Program Office has implemented changes in accordance with the June 2013 response to the Department of Defense Inspector General's 2012 report with respect to cyber security. ALIS continues to be managed as an integral part of the F-35 Air System and we remain fully engaged with the appropriate cyber security organizations to ensure compliance with system certification & accreditation policies per the IG recommendations.

The Program recognizes that ALIS is one of the most significant technical and schedule risks on the program. For too long, the program treated this crucial element of the F-35 weapon systems as a piece of support equipment instead of the very complex, software intensive, total logistics and maintenance system it is. We are now treating ALIS as if it were its own "weapon system". We have implemented a more disciplined engineering process that include periodic design reviews, a new leadership structure, improved lab infrastructure, more realistic testing with greater warfighter involvement, and a more structured incremental software delivery plan and associated metrics. As part of this change, the Program is in the process of standing up an ALIS operational test capability at Edwards Air Force Base in California, as recommended by the IG report. This capability is planned for January 2016, and should lead to more predictable ALIS performance and quicker discovery and corrections before fielding.

IX. System Development and Demonstration to Follow-on Development:

With the F-35's System Development and Demonstration phase on-track to complete in

October 2017, the Follow-on Modernization effort will be the means to deliver improved capabilities to the weapon system to ensure its relevance against advanced and emerging threats. The Modernization Program will be “right-sized” so it is affordable and sustainable. In addition, the Department will ensure that separate cost, schedule, and performance data will be available to provide detailed insight into program execution. To this end, a contract was awarded to Lockheed Martin in June of this year to perform requirements decomposition efforts and conduct an initial System Requirements Review on Block 4 capabilities. We will follow this up with a System Functional Review and a Preliminary Design Review in the 2016-2017 timeframe. The Block 4 Capabilities Development Document (CDD) has completed Air Force Requirements Oversight Council review, and is planned to complete Joint Requirements Oversight Council staffing and approval in spring 2016. The F-35A Dual Capable Aircraft (DCA) will be included in the Block 4 Follow-on Modernization effort. This summer a series of test flights were conducted to assess the thermal, acoustic, and vibration environments of the F-35 weapons bay and characterize the impacts on the B-61 weapon. Data from these tests will be used to support the upcoming Critical Design Review and Baseline Design Review conducted by the Tail Kit Assembly Program Office and Sandia National Laboratories. Nuclear certification planning efforts have also been initiated as part of the Block 4 contracting activity in anticipation of B-61 integration on the F-35 in the coming years.

X. International Partner and FMS Participants:

International participation on the program with 8 Partners and 3 FMS customers remains stable and strong. Just last month, we saw the rollout and first flight of the first Royal Norwegian Air Force F-35 and previous to that the first Italian Air Force F-35A rolled out of the

production facility in Cameri, Italy and had its first flight. We are also now training International Partner pilots at Luke Air Force Base in Arizona. We have also conducted F-35A aerial refueling flight testing with a Royal Australian Air Force KC-30A tanker and completed F-35A aerial refueling flight testing with an Italian Air Force KC-767 tanker.

In 2015 initial site planning commenced standup of maintenance capabilities in Norway, Netherlands, Turkey, United Kingdom, Israel, Japan and Korea.

Letters of Offer and Acceptance (LOA) have been signed for all three FMS Participants, Korea, Israel, and Japan. First Aircraft Arrivals (FAA) are scheduled for each Participant and all activities are on schedule to support their needed delivery dates.

The Japanese Final Assembly and Check Out assembly facility is now complete with both Electronic Mate Assembly Stations tools installed and accepted. Construction and installation activities remain on schedule, and the major components are now being shipped. The first Japanese F-35A is scheduled to rollout of the facility in November 2016.

XI. Conclusion:

In summary, the F-35 program is growing and accelerating and making progress on many fronts, including flight test, production, maintenance, fielding and building a global sustainment enterprise. The program is fundamentally on track and we remain confident to deliver on the program's commitments. As with any big, complex program new discoveries, challenges and obstacles will occur; however, we believe the combined Government/Industry team has the ability to overcome current issues and future discoveries in order to successfully deliver the full F-35 capability to the Warfighter.

The JPO will continue executing with integrity, discipline, transparency and

accountability, holding ourselves accountable for the outcomes on this program. We recognize the responsibility the program has been given to provide the backbone of the U.S. and allied fighter capability with the F-35 for generations to come, and that your sons and daughters, grandsons and granddaughters may someday take this aircraft into harm's way to defend our freedom and way of life. It is a responsibility we never forget.

Thank you again for this opportunity to discuss the F-35. We look forward to answering any questions you have.

Lieutenant General Christopher C. Bogdan

Lt. Gen. Christopher C. Bogdan is the Program Executive Officer for the F-35 Lightning II Joint Program Office in Arlington, Va. The F-35 Lightning II Joint Program Office is the Department of Defense's agency responsible for developing and acquiring the F-35A/B/C, the next-generation strike aircraft weapon system for the Navy, Air Force, Marines, and many allied nations.

General Bogdan was commissioned in 1983 from the U.S. Air Force Academy. He has served as an operational pilot, test pilot, staff officer, executive officer, acquisition program manager, and program director. He is a command pilot and experimental test pilot with more than 3,200 flying hours in more than 35 aircraft types, including the KC-135, FB-111A, B-2 and F-16. He has commanded at the squadron and group levels, and served as the executive officer to the Commander, Electronic Systems Center, and to the Commander, Air Force Materiel Command.

General Bogdan also served as the Program Executive Officer for the KC-46 Tanker Modernization Directorate, Wright-Patterson AFB, Ohio.

Prior to his current assignment, General Bogdan was Deputy Program Executive Officer for the F-35 Lightning II Joint Program Office in Arlington, Va.

EDUCATION

1983 Distinguished graduate, Bachelor of Science degree in aeronautical engineering, U.S. Air Force Academy, Colorado Springs, Colo.

1989 Distinguished graduate, Squadron Officer School, Maxwell AFB, Ala.

1990 Distinguished graduate, USAF Test Pilot School, Edwards AFB, Calif.

1994 Master of Science degree in engineering management, with distinction, California State University, Northridge

1995 Distinguished graduate, Air Command and Staff College, Maxwell AFB, Ala.

1998 Air War College, by correspondence

2000 Distinguished graduate, Master of Science degree in national resource strategy, Industrial College of the Armed Forces, Fort Lesley J. McNair, Washington, D.C.

2005 Advanced Program Managers Course, Defense Systems Management College, Fort Belvoir, Va.

2006 U.S. Air Force Senior Leadership Course, Center for Creative Leadership, Greensboro, N.C.

2007 National Security Management Course, Maxwell School of Citizenship, Syracuse University, N.Y.

2013 Cyber Operations Executive Course, Air University, Maxwell AFB, Ala.

ASSIGNMENTS

1. July 1983 - June 1984, student, undergraduate pilot training, Reese AFB, Texas
2. June 1984 - November 1984, pilot, KC-135 crew training, Castle AFB, Calif.
3. November 1984 - March 1987, pilot, KC-135A and T-37A, 509th Air Refueling Squadron, Pease AFB, N.H.
4. March 1987 - April 1988, pilot, FB-111A Crew Training, Plattsburgh AFB, NY
5. April 1988 - June 1990, FB-111A instructor pilot, 393rd Bomb Squadron, Pease AFB, N.H.
6. June 1990 - June 1991, student, Class 90B, U.S. Air Force Test Pilot School, Edwards AFB, Calif.
7. June 1991 - December 1991, experimental test pilot, 6512th Test Operations Squadron, Edwards AFB, Calif.
8. December 1991 - June 1995, B-2 experimental test pilot, B-2 Chief of Training, B-2 Test Program Manager and Assistant Deputy for Operations, 420th Flight Test Squadron, Edwards AFB, Calif.
9. June 1995 - June 1996, student, Air Command and Staff College, Maxwell AFB, Ala.
10. June 1996 - May 1997, Program Manager, Theater Missile Defense Systems, Special Projects Program Office, Electronic Systems Center, Hanscom AFB, Mass.
11. May 1997 - June 1999, executive officer to the Commander, Electronic Systems Center, Hanscom AFB, Mass.
12. June 1999 - June 2000, student, Industrial College of the Armed Forces, Fort Lesley J. McNair, Washington, D.C.
13. June 2000 - May 2001, Deputy Commander, 412th Operations Group, Edwards AFB, Calif.
14. May 2001 - July 2002, Commander, 645th Materiel Squadron, Wright-Patterson AFB, Ohio
15. July 2002 - September 2003, executive officer to the Commander, Air Force Materiel Command, Wright-Patterson AFB, Ohio
16. September 2003 - June 2005, Commander, Special Operations Forces Systems Group, Wright-Patterson AFB, Ohio

17. June 2005 - May 2006, Deputy Director, Directorate of Global Power, Office of the Assistant Secretary of the Air Force for Acquisition, Headquarters U.S. Air Force, Washington, D.C.
18. May 2006 - May 2008, Senior Military Assistant to the Deputy Under Secretary of Defense for Acquisition and Technology, Office of the Secretary of Defense, Washington, D.C.
19. May 2008 - May 2009, Senior Military Assistant to the Under Secretary of Defense for Acquisition, Technology and Logistics, Office of the Secretary of Defense, Washington, D.C.
20. June 2009 – July 2012, KC-46 Program Executive Officer and Program Director, KC-46 Tanker Modernization Directorate, Aeronautical Systems Center, Wright-Patterson AFB, Ohio
21. July 2012 – December 2012, Deputy Program Executive Officer for the F-35 Lightning II Joint Program Office, Arlington, Va.
22. December 2012 – present, Program Executive Officer for the F-35 Lightning II Joint Program Office, Arlington, Va.

SUMMARY OF JOINT ASSIGNMENTS

May 2006 - May 2009, Senior Military Assistant to Deputy Under Secretary of Defense for Acquisition and Technology, and Senior Military Assistant to the Under Secretary of Defense for Acquisition, Technology and Logistics, Office of the Secretary of Defense, Washington, D.C.

FLIGHT INFORMATION

Rating: Command pilot, parachutist

Flight hours: More than 3,200

Aircraft flown: KC-135A/E, FB-111A, F-16A/B, B-2A, T-37A, T-38, B707, RC-135, T-39A and 25 other aircraft types

MAJOR AWARDS AND DECORATIONS

Defense Superior Service Medal

Legion of Merit

Meritorious Service Medal with six oak leaf clusters

Air Force Commendation Medal

Air Force Aerial Achievement Medal

Air Force Achievement Medal

OTHER ACHIEVEMENTS

Outstanding Cadet in Aeronautical Engineering, U.S. Air Force Academy

British Marshall Scholarship National Finalist

Rhodes Scholar Candidate, U.S. Air Force Academy

Distinguished graduate, KC-135 Training

Outstanding graduate, FB-111A Flight Instructor Course

Company Grade Officer of the Year, Air Force Flight Test Center

PROFESSIONAL CERTIFICATIONS

Program Management, Level III, Acquisition Professional Development Program

Test and Evaluation, Level III, APDP

EFFECTIVE DATES OF PROMOTION

Second Lieutenant June 1, 1983

First Lieutenant June 1, 1985

Captain June 1, 1987

Major March 1, 1995

Lieutenant Colonel Sept. 1, 1998

Colonel Aug. 1, 2002

Brigadier General Dec. 9, 2008

Major General Nov. 18, 2011

Lieutenant General Dec. 6, 2012

(Current as of December 2013)

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SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES
US HOUSE OF REPRESENTATIVES

DEPARTMENT OF THE AIR FORCE

PRESENTATION TO THE
HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES
US HOUSE OF REPRESENTATIVES

OCTOBER 21st, 2015

SUBJECT: F-35 OPERATIONS UPDATE

STATEMENT OF: Major General Jeffrey Harrigan
Director, F-35 Integration Office
Headquarters, USAF

NOT FOR PUBLICATION UNTIL RELEASED BY
HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES
US HOUSE OF REPRESENTATIVES

I. Introduction

Chairman Turner, Ranking Member Sanchez and distinguished members of the Tactical Air and Land Forces Subcommittee, thank you for the opportunity to provide an update on the United States Air Force's progress toward declaring initial operating capability (IOC) for the F-35A. The combination of F-35 lethality, survivability and adaptability make it our platform of choice for operations in a highly-contested threat environment. The aircraft's state-of-the-art sensor fusion, networked interoperability, and broad array of advanced air-to-air and air-to-surface munitions enables unmatched lethality well into the 21st century. The F-35's exceptional survivability is achieved through a combination of low-observable technologies, advanced electronic attack and electronic protection, and shared situational awareness. Its multi-role capabilities are optimized for Global Precision Attack while complementing our air superiority fleet. It will form the backbone of future joint and combined air operations – enabling future Joint force commander success.

The F-35 program has reached several milestones in 2015. Luke Air Force Base, Arizona, began training F-35 student pilots on January 23, 2015. The 31st Test and Evaluation Squadron's F-35As, from Edwards Air Force Base, California, flew as the close air support platform for the Green Flag 15-08 exercise. On 25 June, they worked with soldiers from the 1st Brigade Combat Team, Fort Bliss, Texas. Basic Close Air Support is one of the baseline missions for our IOC declaration. Also in June, two F-35As assigned to the 16th Weapons Squadron, Nellis Air Force Base, Nevada, were the first F-35s to participate in a capstone large-force employment exercise with the United States Air Force Weapons School. The 34th Fighter Squadron at Hill Air Force Base, Utah, the Air Force's IOC fighter squadron, took delivery of its first two F-35As on September 2, 2015 and expects to have 12 aircraft by the end of May 2016. On September 23, 2015 the Integrated Test Force at Edwards Air Force Base, California, completed developmental test of the Block 3i mission software, which will be the baseline for the Air Force IOC declaration. Finally, the first external weapons release tests, internal gun tests, and the first operational ordnance expenditures all occurred during 2015, showing clear progress towards operationalizing the F-35.

Ultimately, the F-35 program has turned the corner since the 2010 restructuring effort. Although it is by no means perfect, and there will certainly be more challenges uncovered as we

continue development, the program is progressing at a steady pace and making progress in critical areas to ensure we deliver the most combat capable aircraft to the warfighter. In order to fulfill that goal, we need continued support from this committee and the rest of Congress.

II. Air Force Initial Operational Capability Update

Today, the program is on the road to initial operational capability (IOC) for the Air Force, and we expect to declare IOC as planned in 2016. Going forward, we will continue to closely monitor progress. The Air Force is tracking 12 specific requirements to declare IOC. These requirements include the following:

1. Aircraft Available. As of September 2015 the Air Force is on track to receive 14 aircraft by 1 August 2016. The minimum required is 12. This is seen as low risk to IOC.

2. Block 3i capability. Block 3i software will allow the aircraft to perform basic Close Air Support (CAS), interdiction and limited Suppression of Enemy Air Defenses (SEAD)/ Destruction of Enemy Air Defenses (DEAD) operations in a contested environment. Block 3iR6.01 was released to the operation test fleet at Nellis AFB and Edwards AFB on 1 October 2015. This resulted from close coordination between the Air Force, the F-35 Joint Program Office (JPO) and Lockheed Martin. The final software version for Block 3i is 3iP6 and is expected to be released in February 2016 to the fleet. The Air Force sees this software development as a potential risk for IOC until it has been fully tested and explored by our operational testers; however, developmental ground testing results note improvements in stability. Operational testing began flying with the new software last week.

3. All jets modified with the required hardware for full 3i implementation. The Air Force IOC aircraft at Hill AFB will need modifications to bring them to full Block 3i configuration. The modifications are due to discoveries in developmental testing and are a direct result of concurrent weapons system development. These modifications will bring the aircraft up to the full 3i aircraft operating envelope, and adds airborne lightning protection and weapons employment capabilities. One major modification still under consideration for IOC is the fuel over-pressurization modification. The program engineers are still working to determine if this modification must be fixed immediately or if the Air Force can delay the work until the normal

depot rotation for each aircraft. The decision is expected in early December 2015. If required, the fuel overpressure modification will increase the Air Force's risk to declaring IOC by 1 August.

4. Proper Joint Technical Data and Flight Series Directives. The Air Force requires all of the electronic checklists, work orders and operating instructions associated with the new F-35 equipment to ensure maintainability and weapon system support. The Air Force considers this requirement on track and not a risk to IOC.

5. Autonomic Logistics Information System (ALIS) 2.0.2 software with Squadron Operating Unit (SOU) v2. This is a high risk item. ALIS 2.0.2 software is focused on deployed operations and will allow a flying unit to deploy aircraft forward while continuing to report metrics data back to the home station. It also allows for the lateral transfer of pilots and support equipment between squadrons. The new software is scheduled for delivery on July 29, 2016 just prior to IOC; however, there is high risk in the program's ability to train and familiarize our maintainers with the new software. As a result, the Air Force has partnered with Lockheed Martin to provide training on the new software during testing. Further, the JPO is establishing a parallel software testing network with the aircraft test fleet at Edwards to provide a realistic operational environment that will ensure earlier operational testing.

6. Mission Data File delivery. The mission data file loads enable the aircraft's sensors to identify and categorize threat radio frequency emissions, a capability critical to the aircraft's combat effectiveness. The loads are produced by a government laboratory, the U.S. Reprogramming Lab (USRL) at Eglin AFB. The lab is tasked with delivering 4 different Areas of Responsibility (AOR) for specific geographic regions of the world. Currently, the lab is on track to provide 3 of the AORs prior to the Air Force IOC objective date. The fourth AOR is forecast to deliver one month later, within the IOC window.

7. Pilots and maintenance personnel trained. Mission qualification pilot training and maintenance scheduling is impacted by the aircraft modification decision on potential fuel overpressurization mentioned earlier. If the aircraft need the fuel overpressure modification prior to IOC the number of aircraft available for pilot training is reduced and increases the risk to IOC. However, the Air Force is working to mitigate this risk by temporarily transferring Hill AFB operational pilots to other F-35 units to accomplish the required training. Maintenance training is not affected by the pending modification decision; there are sufficient numbers of experienced

F-35 maintenance personnel in place to support IOC requirements but still project a 1,500 maintenance manning shortfall to meet F-35 requirements between FY17-19.

8. GEN III helmets fielded. The Generation III (GEN III) helmet improves on the Generation II helmet that is currently fielded. These improvements include an improved night vision camera, reduced helmet jitter, and fixes to the “green glow” associated with the Gen II helmet. As of October 5, 2015, there are 4 pilots flying with the GEN III helmets and 3 more are in the process of being fitted for the new helmet. Hill AFB will execute their first night flights later this month to verify the improved night vision system.

9. Weapons testing and certification complete. As of September 30, 2015 one Guided Bomb Unit (GBU)-12 inert laser guided weapons and two fully explosive GBU-31 weapons have been dropped by Air Force operational test aircraft during operational testing. Operational testing will continue throughout System Development and Demonstration. Operational unit clearance to employ weapons is expected with 3iP6 (production software release) in 1QCY16. Weapons testing and certification is on track and will minimally impact IOC.

10. Spares. The Air Vehicle spare package is funded and the deployable spares package is projected to be in place to meet IOC requirements.

11. Proper Support equipment and Alternate Mission Equipment. Not all of the contracted quantities of support equipment will be delivered in time for IOC; however, the program office has a plan to borrow the minimum Support Equipment required from the Depot to ensure enough equipment will be available. There is some risk to IOC.

12. Pilot and Maintainer Manning. Pilot Manning: The Air Force has sufficient pilot manning for our planned IOC. There are longer term issues related to AF enterprise-wide fighter pilot manning shortfalls that are being addressed. Specifically regarding the F-35A, we will carefully manage the fighter pilot inventory as the fighter force structure evolves. Our focus is to ensure the right balance of qualified pilots, with the correct experience levels, are assigned to our growing F-35A fleet in balance with other combat fighter platforms.

The Air Force has completed actions that have addressed the maintenance manning concerns to meet F-35 IOC in 2016. However, we still project a 1,500 maintenance manning shortfall to meet F-35 requirements between FY17-19. In order to mitigate this shortfall we are

evaluating several options to include increasing the active-duty end strength, leveraging more Total Force maintenance manning solutions, and contracting additional maintenance requirements.

III. Operators perspective of the progress on issues highlighted during 27 March 2015 visit to Eglin AFB

On March 27, 2015 a Tactical Air and Land Forces congressional delegation visited Eglin Air Force Base, Florida, to discuss the F-35 program and current state of training operations. There were numerous pilot and maintenance issues identified during that visit related to the F-35 air combat system. We will address each of the concern areas:

1. **Comment: F-35 personnel were uncomfortable with L-M's scale of control over the maintenance program due to ALIS and other policies in place that limit their ability to work on the aircraft. In particular, the inability to maintain an on-hand parts inventory and a prohibition on making parts on-site were noted.** The Air Force shares the concerns of the Eglin personnel, but the reason behind the current frustration is due to the concurrent development process of the program. There are going to be growing pains as the Air Force continues to operationalize the F-35. Although the operators want to move-out quickly and have the capability to perform functions similar to what they have done on legacy platforms, the F-35 is still in development and requires greater oversight on aircraft repairs and modifications. As the aircraft with its associated maintenance procedures and published guidance mature, more and more functions will be accomplished at the unit level.
2. **Comment: ALIS information, and L-M info, on parts status is still not always accurate. The 'just-in-time' parts system leads to significant wasted time and effort, and lower availability for training.** The Air Force concurs and we are working closely with the JPO, partner nations and other services to consolidate warfighter input on the deficiencies and are working to incorporate the appropriate fixes.
3. **Comment: Concerns about the international supply chain and the length of time it takes to get parts.** The Air Force concurs with this concern. As the F-35 matures, more historical maintenance data is collected, and better forecasting is subsequently available, it will be easier to ensure higher-use parts are on hand locally.

4. **Comment: Concerns about "false positives" with ALIS. Maintenance personnel said that the rate of false positives was around 80%.** Decreasing false positives are an objective inherent in every software version but will not wholly disappear. In the interim, significant effort has gone into creating Nuisance Fault Lists (NFLs) to reduce unproductive maintenance time.

5. **Comment: Debrief downloads take 2 hours, which significantly disrupts the normal debriefing cycle, resulting in a huge loss of training value. Needs to be 1 hour or less.** The JPO is acquiring the Generation III Ground Data Security Assembly Receptacle (GDR) to speed up the debrief download process thereby shortening the debrief cycle. The GDR is used to encrypt and decrypt the mission data carried on the Portable Memory device (PMD). The new Generation III GDR will significantly reduce the time required to decrypt the PMD and provide debrief video to the pilots quicker than the current GDR II. The Generation III GDR completed Critical Design Review in September 2015. Production Generation III GDRs will begin deliveries in June/July 2016 with the first ten units delivered to Hill AFB in August 2016.

6. **Comment: Flight gear is not comfortable or practical. Too constraining. Does not allow pilots to relieve themselves without unstrapping from the entire restraint system. Overall lack of comfort and suitability.** The Air Force shares this concern and is actively looking for alternatives to include alternate flight gear. However, full testing and approval will not occur until 2019 and depends on available funding. Although it is not uncommon to unstrap in legacy fighters for the pilot to relieve themselves, a redesign of the seat and flight equipment would be required to remove this limitation.

7. **Comment: Rear visibility very limited compared to F-15 and F-16. Made worse by the ejection seat configuration that is intended to protect against injuries.** The Air Force understood the design trade-offs made in the F-35 to preserve adequate neck and head support as well as provide the best stealth/low observable capability possible. Additionally, the Operational Test community is currently designing the tactics, techniques and procedures (TTPs) to best employ the F-35.

8. **Comment: IOC capability using 3i software will be very limited, and will only allow the use of "old" weapons, not the latest and greatest available. They are worried that the IOC won't be "for real" if they have to deploy and fight with 3i.** Yes, Air Force warfighting capabilities will be limited at IOC and will not achieve its full warfighting

configuration until the end of SDD. To that end, we are working with the program office to ensure an Operational Requirements Document (ORD) compliant aircraft is delivered by the end of SDD.

9. **Comment: The cycle time on software fixes is too long. Things get fixed, but it takes months after the problem is identified.** The program office has been responsive to Air Force prioritized inputs for deficiency corrections, especially those required for IOC. Unfortunately, there are limits on the time and funds available to correct all deficiencies.

10. **Comment: Concerns about quality of the gun aiming system. When combined with very small ammo load they think it might be a step backwards from legacy aircraft.** Internal gun tests recently completed at Edwards Air Force Base, California, indicate that the F-35's gun accuracy should be similar to legacy aircraft. There are also Air-to-Air and Air-to-Ground gun tests scheduled through late summer 2016, and we should have a better understanding of the total system's accuracy at that time.

11. **Comment: Electro-Optical Targeting System (EOTS) limitations compared to external targeting pods, especially for CAS.** The Air Force looks forward to improving the EOTS during Block 4 upgrades. The Air Force concurs with the F-35 PEO memorandum dated September 9, 2015 to the Honorable Michael Turner, Chairman, Tactical Air and Land Force Subcommittee reference the March 27, 2015 CODEL visit to Eglin Air Force Base, Florida, quoted here for convenience: "The F-35's EOTS performance requirements were established as part of the development baseline in the mid-2000s. Meanwhile, development in external targeting pod capabilities has continued to progress, while F-35 has worked to integrate EOTS based on its unique requirement set. The F-35 will deliver an initial baseline warfighting capability that meets the warfighter's needs; however, it will not initially execute every mission with the same capability that exists in currently fielded/upgraded platforms that have benefitted from technology investment. The F-35 has significant growth potential and at the end of Development (end of CY2017) the Program will begin its Follow-on Development work which will include upgrades and technology insertion of its sensors. Improving EOTS to leverage the significant investment in targeting pod capabilities over the last 10 years is a high priority in Follow-on-Development (Block 4)."

12. **Comment: "Old weapons on 5th gen aircraft". Newer, better weapons won't be usable at IOC. Will come much later.** Air Force is working and will continue to work with

the program office to increase the number of certified weapons on the F-35. The Air Force concurs with the F-35 PEO memorandum dated September 9, 2015 to the Honorable Michael Turner, Chairman, Tactical Air and Land Force Subcommittee reference the March 27, 2015 CODEL visit to Eglin Air Force Base, Florida, quoted here for convenience: “The weapons planned for release with Block 2B in 2015 and Block 3F in 2017 are expected to meet Service requirements. The program must first complete development with the basic weapons in the Services current inventories before embarking on newer weapons. Newer weapons such as GBU-38/54 (500 pound Laser Joint Direct Attack Munition and Small Diameter Bomb-II (GBU-53) are planned for integration on the F-35 beginning with Follow-on-Development in the 2019-2021 timeframe.”

13. **Comment: IOC with only two air-to-air weapons max load, not four.**

Significant concern about going to combat with that limited load. The Air Force concurs with the F-35 PEO memorandum dated September 9, 2015 to the Honorable Michael Turner, Chairman, Tactical Air and Land Force Subcommittee reference the March 27, 2015 CODEL visit to Eglin Air Force Base, Florida, quoted here for convenience: “It is true that in Block 2B/3i the aircraft will be capable of only two Advanced Medium Range Air-to-Air Missiles (AMRAAM) carried internally--but again this is a limited capability that will be improved with the full Block 3F capability in late 2017. With Block 3F the internal AMRAAM capability will double to four. Post SDD, the authorized AMRAAM Load outs can be increased to the maximum aircraft capability of 12 missiles, carried both internally and externally.”

14. **Comment: MADL is not currently compatible with IFDL (F-22) data link.**

Multi-function Advanced Data Link (MADL) and Inflight Data Link (IFDL) were never meant to be compatible. However, there is a requirement for the F-35 and other Air Force platforms to interoperate in the joint combat environment. Link-16 allows for limited data sharing between the F-22 and F-35. There are potential options being investigated on both the F-22 and F-35 side to improve interoperability between the aircraft, but depending upon service priorities and available funding, those options may not be available for a number of years.

IV. Budget Impact

As previously noted by our senior AF leaders, the current Continuing Resolution and any long-term CRA puts in jeopardy the Air Force's ability to meet defense strategy requirements for

current and emergent contingency operations and delays critical steps in recapitalizing aging fleets and infrastructure. An extended or year-long CR funds the AF at a constrained FY15 enacted level, or \$13.4B less than the requested FY16 PB. The F-35 is a significant part of this needed modernization and recapitalization. For the F-35A program specifically, a short term CRA delays the award of the LRIP 10 contract and limits the AF purchase to the FY15PB level of 28 aircraft, 16 aircraft less than requested in the President's budget. Any long-term CRA limits us to these FY15PB purchase levels with a likely result of an increased cost per aircraft to the AF and the taxpayer. This also limits some of our crucial RDT&E efforts necessary to meet our required capabilities for SDD, for example Band 2/5 funding, and our next Block of improvements for Follow-on Development. Lastly, a longer-term CRA affects our MILCON projects, more directly our F-35A bed down and facilities for Eielson AFB, Alaska, due for award in FY16.

V. Ejection Seat Issues

There were two sled test failures while qualifying the GEN III helmet in the F-35. These failures were in the low speed regime (approximately 160 KEAS) and light pilot weight (less than 136 lbs.). The pilot-seat center of gravity is offset from the thrust line, resulting in aft rotation of the seat for lower weights, and during parachute opening the neck experiences excessive extension or whiplash forces. Based on data analysis, the Air Force made the decision to ground F-35 pilots weighing below 136 pounds (high risk for debilitating injury). This policy only affected one pilot. The ejection seat contractor, Martin Baker, is currently working on permanent solutions that are expected to be available for Low Rate Initial Production (LRIP) 10 aircraft in late 2017. Ultimately, the Air Force wants a seat that meets ORD requirements without workarounds. While cost could be a factor in finding a solution, the performance of the ejection system is a priority to ensure the survivability of our pilots.

VI. Maneuverability Characteristics

Both operational and developmental testing continues for the F-35. The F-35 is designed to be comparable to current tactical fighters in terms of maneuverability, but the design is optimized for stealth and sensor superiority. News reports on the F-35's performance against an F-16 was an early look at the F-35's flight control authority software logic, and not an

assessment of its ability in a dogfight situation. The Operational Test Wing has just completed the first two phases of the within visual range (WVR) Tactics Investigation (TI) consisting of Aircraft Handling Characteristics and Basic Fighter Maneuver exercises. Comments from the operational testers state that the "Initial handling results are generally positive at this stage of tactics development and are comparable to current tactical fighters". Operational units are just starting to train their pilots on these first two stages of WVR tactics.

The F-35's technology is designed to engage, shoot, and kill its enemy from long distances, not necessarily in visual "dogfighting" situations. There have been numerous occasions where a four-ship of F-35s has engaged a four-ship of F-16s in simulated combat scenarios and the F-35s had a clear operational advantage because of its sensors, weapons, and stealth technology. The F-35 has been optimized for the current trends in air warfare, where the enemy is engaged and defeated from long distances, but it will still be able to maneuver aggressively when required to defeat and kill threats.

VII. Conclusion

The F-35A is developing according to plan. IOC will be an event/capability based recommendation by the Commander of Air Combat Command to the Chief of Staff of the Air Force based on the performance of the entire weapons system.

In order to get to IOC the Air Force must keep pressure on the program managers and developers to deliver the capabilities defined in the ORD and by the Commander of Air Combat Command. This includes providing ALIS 2.0.2, a critical enabler to maintain and operate our fleet in a deployed environment. Development, testing and training is currently on track for a July 29, 2016 delivery so this item must be tracked and measured very closely to ensure it is ready for the warfighter.

Finally, while IOC is an important milestone for the program we must not lose sight of the ultimate goal of full war fighting capability. The program must develop and deliver 3F software on time and invest now in Block 4 follow on development to ensure that the warfighter has the most current and relevant capabilities our nation's warfighters require to meet the future fight. The capability advantage that the Air Force has enjoyed over potential adversaries is

closing fast. Modernization is critically important to our Air Force! Air Forces that fall behind the technology curve, fail, and in modern warfare, if the Air Force fails, the Joint force fails.

Thank you again for this opportunity to discuss the F-35. I look forward to answering any questions you have.

Major General Jeffrey L. Harrigian
Director, F-35 Integration Office

Maj. Gen. Jeffrey L. Harrigian is Director, F-35 Integration Office, Headquarters U.S. Air Force, the Pentagon, Washington, D.C. General Harrigian assists the CSAF in consolidating oversight, improving communications and establishing Air Force F-35 priorities. He is responsible for integrating activities across air staff directorates, the Office of the Secretary of Defense, partners, Department of the Navy, U.S. Marine Corps, major commands and the Joint Program Office to ensure connectivity of information and decisions across the F-35 enterprise. The F-35 Integration Office is the single point of contact for all Air Force F-35A matters and is the Air Force's primary conduit of senior leader information flow to the Joint Program Office (JPO).

General Harrigian was commissioned in 1985 as a graduate of the U.S. Air Force Academy. He has served in a variety of flying and staff assignments, including Chief of the Joint Exercise Division at NATO's Joint Warfare Center, Stavanger, Norway. He has commanded at the flight, squadron and wing levels. The general is a U.S. Air Force Weapons School graduate and a command pilot with more than 4,100 flight hours in the F-22, F-15C, A/OA-37 and MQ-1. He has flown combat missions in support of operations Just Cause and Desert Storm and also served as the Deputy Director for Strategy, Plans and Assessments, U.S. forces-Iraq, in support of Operation Iraqi Freedom and the Deputy Director of Operations (J3) at U.S. Central Command, Mac Dill Air Force Base, Florida. Prior to his current assignment, he served as the Assistant Deputy Chief of Staff, Operations, Headquarters U.S. Air Force, the Pentagon, Washington, D.C.

EDUCATION

1985 Bachelor's degree in political science, U.S. Air Force Academy, Colorado Springs, Colo.
 1993 Squadron Officer School, by correspondence
 1995 U.S. Air Force Fighter Weapons Instructor Course, Nellis AFB, Nev.
 1996 Master's degree in aeronautical science, Embry-Riddle Aeronautical University, Daytona Beach, Fla.
 1999 Army Command and General Staff College, Fort Leavenworth, Kan.
 2002 Air War College, by correspondence
 2005 Air Force Fellow, George C. Marshall European Center for Security Studies, Garmisch-Partenkirchen, Germany
 2008 Enterprise Leadership Seminar, University of North Carolina at Chapel Hill
 2008 Phase II, Joint Professional Military Education, Joint Forces Staff College, Norfolk, Va.
 2011 Joint Force Air Component Commander, Maxwell AFB, Ala.
 2012 Joint Flag Officer Warfighting Course, Maxwell AFB, Ala.
 2015 Combined/Joint Force Special Operations Component Commanders Course, MacDill AFB, Fla.

ASSIGNMENTS

1. July 1985 - August 1986, Student, undergraduate pilot training, Williams AFB, Ariz.
2. April 1987 - January 1990, A/OA-37 Air Liaison Officer, Forward Air Controller Instructor Pilot, and Standardization and Evaluation Pilot, 24th Tactical Air Support Squadron, Howard AFB, Panama
3. March 1990 - September 1990, Student, F-15 replacement training, 555th Tactical Fighter Squadron, Luke AFB, Ariz.
4. September 1990 - June 1992, Squadron Life Support Officer, later, Chief, Squadron Scheduling, 8th Tactical Fighter Squadron, Holloman AFB, N.M.

5. July 1992 - June 1995, Chief, Squadron Scheduling, 1st Tactical Fighter Squadron, and Academic Instructor, Multi- Stage Improvement Program, 325th Training Squadron, Tyndall AFB, Fla.
6. July 1995 - December 1995, Student, U.S. Air Force Weapons Instructor Course, Nellis AFB, Nev.
7. January 1996 - June 1998, Chief, Weapons and Tactics, 58th Fighter Squadron, and Chief, Wing Weapons, 33rd Operational Support Squadron, Eglin AFB, Fla.
8. June 1998 - June 1999, Student, Army Command and General Staff College, Fort Leavenworth, Kan.
9. June 1999 - August 1999, Student, F-15 requalification training, Tyndall AFB, Fla.
10. August 1999 - January 2000, Instructor Pilot, F-15 Division; and Chief, Advanced Programs, Director of Tactics, U.S. Air Force Weapons School, Nellis AFB, Nev.
11. January 2000 - May 2001, Operations Officer, F-15 Division, U.S. Air Force Weapons School, Nellis AFB, Nev.
12. May 2001 - October 2002, Operations Officer, 95th Fighter Squadron, Tyndall AFB, Fla.
13. October 2002 - December 2004, Commander, 43rd Fighter Squadron, Tyndall AFB, Fla.
14. December 2004 - August 2005, Air Force Fellow, George C. Marshall European Center for Security Studies, Garmisch-Partenkirchen, Germany
15. August 2005 - June 2007, Chief, Joint Exercise Division, NATO's Joint Warfare Center, Stavanger, Norway
16. June 2007 - January 2008, Vice Commander, 1st Fighter Wing, Langley AFB, Va.
17. January 2008 - June 2010, Commander, 49th Fighter Wing, Holloman AFB, N.M.
18. July 2010 - July 2011, Deputy Director for Strategy, Plans and Assessment (J5), U.S. Forces-Iraq, Baghdad, Iraq
19. August 2011 - January 2013, Assistant Deputy Commander, U.S. Air Forces Central Command, and Assistant Vice Commander, 9th Air Expeditionary Task Force, Shaw AFB, S.C.
20. February 2013 – July 2014, Deputy Director, Operations (J3), U.S. Central Command, Mac Dill AFB, Fla.
21. August 2014 – April 2015, Assistant Deputy Chief of Staff, Operations, Headquarters U.S. Air Force, the Pentagon, Washington, D.C.
22. April 2015 – present, Director, F-35 Integration Office, Headquarters U.S. Air Force, the Pentagon, Washington, D.C.

SUMMARY OF JOINT ASSIGNMENTS

1. August 2005 - June 2007, Chief, Joint Exercise Division, NATO's Joint Warfare Center, Stavanger, Norway, as a colonel
2. July 2010 - July 2011, Deputy Director for Strategy, Plans and Assessments (J5), U.S. Forces-Iraq, Baghdad, Iraq, as a brigadier general
3. February 2013 – July 2014, Deputy Director, Operations (J3), U.S. Central Command, MacDill AFB, Fla., as a brigadier general and major general

FLIGHT INFORMATION

Rating: command pilot
 Flight hours: more than 4,100
 Aircraft flown: F-22, F-15 A/B/C/D, A/OA-37 and MQ-1

MAJOR AWARDS AND DECORATIONS

Defense Superior Service Medal
 Legion of Merit with one oak leaf cluster
 Bronze Star
 Purple Heart
 Defense Meritorious Service Medal

Meritorious Service Medal with three oak leaf clusters
Air Medal
Aerial Achievement Medal with two oak leaf clusters

OTHER ACHIEVEMENTS

1986 Distinguished graduate, undergraduate pilot training
1989 OA-37 Instructor Pilot of the Year, Tactical Air Command
1995 Outstanding graduate, U.S. Air Force Weapons School
1996 Air Force Anthony C. Shine Award
1997 Safety Award of Distinction, Air Combat Command
1998 Ten Outstanding Young Americans Award, Air Combat Command
1998 Instructor Pilot of the Year, 33rd Fighter Wing

PUBLICATIONS

"Fighting the Fulcrum," Fighter Weapons Review and AFTTP 3-1, Vol. 4.

EFFECTIVE DATES OF PROMOTION

Second Lieutenant May 29, 1985
First Lieutenant May 29, 1987
Captain May 29, 1989
Major Jan. 1, 1997
Lieutenant Colonel May 1, 2000
Colonel Feb. 1, 2006
Brigadier General Nov. 11, 2010
Major General Feb. 7, 2014

QUESTIONS SUBMITTED BY MEMBERS POST HEARING

OCTOBER 21, 2015

QUESTIONS SUBMITTED BY MR. TURNER

Mr. TURNER. The committee is concerned that the Follow-on Development program requirements are unbridled and will evolve into the magnitude of the current System Development and Demonstration. What are you doing to keep Follow-on Development within reason?

General BOGDAN. The Program Office agrees with the concern of unaffordable requirements in Follow-on Modernization expressed by Congressman Turner. In the F-35 case, 11 major stakeholders, the US Services eight (8) Partner nations, are ultimately responsible for future F-35 requirements. All of the stakeholders are acutely aware that there are affordable, practical limits to the F-35 modernization effort and are cooperating fully to constrain Block 4 to affordable and technically realistic increments. Affordability assessments from the US Services and Partner's Ministry of Defenses serve as significant elements of that effort.

The process used to define the Follow-on Modernization program requirements includes a significant screening/gating process that evaluates each of the proposed capabilities based on warfighter priority, technical maturity, risk and readiness for integration, schedule and cost. Once the US Services and Partners define the affordable set of Block 4 capabilities, these capabilities will be "frozen" and only through a well-defined governance process spelled out in the well-established F-35 US Service and Partner Memorandum of Understanding, can these requirements change, grow, or be removed.

Mr. TURNER. The Fiscal Year 2016 National Defense Authorization Act included a legislative provision that limits F-35 procurement until the Secretary of the Air Force certifies that F-35A's delivered during FY2018 will have full Block 3F capability. What is the impact of this provision and what is your plan to address it?

General BOGDAN. The Joint Program Office (JPO) has initiated action to ensure full capability is received prior to FY18. The low rate initial production (LRIP) 9 contract, currently being negotiated with the contractor, contains requirements for full 3F capability in delivered jets beginning in August 2017. The subsequent LRIP 10 contract includes this same requirement—full 3F capability—for jets to be delivered in FY18. The JPO is working with the Air Force to obtain Secretary of the Air Force certification should this provision become law.

Mr. TURNER. We are now operating under a continuing resolution. What are the impacts of this and what would the impacts be if we have a yearlong CR?

General BOGDAN. While the F-35 program is able to function under a short term continuing resolution (CR) without driving significant impacts to the program, a long-term CR would be detrimental to the F-35 production ramp-up and drive increased costs for the United States and our International Partners. It would restrict the government's ability to award the full quantity of U.S. F-35 aircraft to be procured in the Low Rate Initial Production (LRIP) 10 contract until the 2016 defense budget is approved. Should the program operate at fiscal year 2015 budget levels, for a long period of time the Department would be unable to provide 16 F-35As for the U.S. Air Force and three (3) F-35Bs for the U.S. Marine Corps. If the Department is unable to procure these 19 aircraft on the LRIP 10 contract, there would potentially be increased costs for not only the 19 US aircraft but also for the other aircraft in LRIP 10 as the JPO would have to modify the current LRIP 10 contract to remove those 19 aircraft, resulting in cost increases for all the aircraft. A long-term CR would also negatively impact the program's ability to move forward with early planning of F-35 Follow-on Modernization, which is the next phase of the program once System Development and Demonstration (SDD) ends in October 2017. Up to a year's delay of Follow-on Modernization Program could result from an extended CR.

Mr. TURNER. Please share with us your current thinking on a Production Block Buy. What is your strategy? What are the major decision points? Do you have "buy in" from the International partners/services? What savings are currently projected? What authorization are you expecting from us?

General BOGDAN. The Joint Program Office (JPO) is working to obtain approval to enter into a future Block Buy Contract (BBC) for more than 400 aircraft. BBC savings are obtained primarily through Economic Ordering Quantity (EOQ) funding

that allows the contractors to purchase materials in quantities greater than those required for a single year's production. EOQ is similar to Advance Procurement funding in that it is funding required one year early; it is not an additional investment.

The JPO received Rough Order of Magnitude (ROM) proposals from Lockheed Martin (LM) and Pratt & Whitney (P&W) for BBC. JPO's assessment of the ROMs reflected that if the Partners/Services provide 4% Economic Order Quantity (EOQ) funding (4% of the total contract cost for all the aircraft) and provide \$300M in Cost Reduction Initiatives (CRI) funding; a cost savings in excess of \$2B will result. RAND Corporation (Project Air Force) has been put on contract to conduct an independent assessment of cost with final results being provided March 2016. RAND's interim assessment of LM's ROM estimate was that LM's savings estimate was reasonable but conservative. RAND believed that it is possible to achieve overall greater savings than LM estimated through a more thorough analysis of the entire supply chain. This is understandable because LM had limited time to complete the ROM and thus, LM could not investigate the lower tiers of the supply chain.

The Congress will be asked to authorize both a Block Buy Contracting strategy and EOQ purchase the year prior to the first year of the Block Buy. Using aircraft quantities from the current program of record, the draft proposed language reads:

The Secretary of Defense may award block buy contracts to cover three production lots of up to 60 F-35B Lightning II Joint Strike Fighter aircraft and F135 engines for the Marine Corps, and up to 30 F-35C Lightning II Joint Strike Fighter aircraft and F135 engines for the Navy; up to 180 F-35A Lightning II Joint Strike Fighter aircraft and F135 engines for the Air Force; and up to 222 F-35A Lightning II Joint Strike Fighter aircraft and F135 engines, and up to 22 F-35B Lightning II Joint Strike Fighter aircraft and F135 engines for international customers. Such contracts may include the procurement of materiel and equipment in economic order quantities.

Mr. TURNER. The F-35 program plans to ramp up aircraft production over the next 4 years. What is the readiness level of the prime contractor and the engine contractor to meet production requirements, and how are you assuring their readiness to do so?

General BOGDAN. While there is moderate risk in delivering approximately 120 aircraft in Low-Rate Initial Production (LRIP) 11 (four years from now), the technical and production risks have been identified, are manageable, and considered acceptable to proceed in production. The F-35 Program's ability to transition to higher production rates continues to be demonstrated, having delivered over 142 aircraft. Potential risks to get to higher production rates are continually monitored and managed through multiple forums such as formal Production Readiness Reviews (PRRs), informal PRRs, and through standard supply chain management (SCM) contractor oversight business practices.

Formal PRRs are contractually required and conducted annually. They are focused on the top high risk suppliers and prime contractors. Sub-tier supplier reviews are led by the prime contractors with the Government acting as an active participant. Prime contractor PRRs are led by the Government. Informal PRRs are conducted by the prime contractors on the next level of risk suppliers and follow a similar format as the formal PRR but may be tailored to the supplier under review. The rest of the supply chain is managed through standard SCM oversight. The JPO can provide the PRR results for the past few years to the Defense Committees if requested.

Mr. TURNER. What is the status of completing the long-term fix for the F-35's engine problem discovered during the engine fire and failure in June 2014? When will all aircraft be modified with the long-term fix for this problem?

General BOGDAN. The F-35 Joint Program Office (JPO) was able to determine root cause for the engine failure, and developed an interim solution: a "pre-trenched" rub material that has been implemented in the field and on the production line. Retrofit of the entire fleet is over 50 percent complete and will be completed in spring of 2016. Production cut-in began in April 2015. Pratt & Whitney has agreed to cover the costs for the repairs to engines in the field and the cut-in of the solution to the production line, while the program office will pay for the design activity as per the development contract. The corrective action team studied several re-design options including the interim pre-trench solution and determined that the pre-trench design was the best performing and most affordable solution for the long term.

Mr. TURNER. Our visit to Eglin AFB in March, both pilots and maintenance personnel reported problems with the Autonomic Logistics Information System or "ALIS." The pilots were concerned about the time it takes to get information for debrief and the maintenance personnel were concerned about the false reporting codes.

Please provide an update on how the F-35 Program Office is addressing those issues.

General BOGDAN. The F-35 air system is experiencing some “false” Health Reporting Codes (HRC) generated by the aircraft, then downloaded and filtered in ALIS. This is manifested in the early software versions (Block 1B and Block 2A) of the F-35 software, which are being used at Eglin Air Force Base. Many of the aircraft-generated HRCs do not require maintenance action (false codes) but do generate work orders that cause unnecessary administrative burden for maintainers and pilots to close out the action. The release of Block 2B software has resulted in an improvement cutting these false codes over earlier Block 1B/2A versions in half.

The “80% false positive” figure is related to the work-orders that ALIS automatically generates after each flight. As an example, a given aircraft may generate 20 HRCs after a flight. Of those 20, any number of them (50%, or 10, in this example) may be automatically flagged as not valid and removed by systems within ALIS—this function is called the Nuisance Filter List (NFL). The remaining 10 HRCs would result in work-orders requiring maintenance personnel action. This is where the reports of “80% false positives” come into play—eight of these work-orders are potentially false positives and require a maintainer to take administrative steps to close. The final two would be “legitimate” work-orders that warrant maintenance actions.

Both the aircraft (false HRCs) and ALIS (proper filtering) contribute to this issue. Valid HRC software fixes are being addressed in the aircraft software via Software Product Anomaly Reports. With these software updates, “false” work orders for the maintenance personnel will continue to be reduced with each aircraft software release. The Joint Program Office (JPO) is also updating the ALIS software to improve correlation of HRCs and consolidation of work orders. The ultimate goal with the improvements of both the aircraft off-board prognostics health monitoring system and ALIS software is negligible false positives by the end of 3rd Quarter of 2017.

Mr. TURNER. Recently, Martin-Baker experienced injury risk exceedances on two ejection seat sled tests related to neck loadings. Can you please describe the failures, what they mean and the Air Force response to these recent failures?

General HARRIGIAN. Both of these exceedances were during slow speed (~160 knots) ejections, one with a 103 pound manikin, and one with a 136 pound manikin. In both cases, the exceedances were caused by over rotation of the seat, causing an improper body position relative to the risers at opening shock, resulting in a whip-lash-like motion force that exceeded injury risk criteria. The risk is “High” for the lightest weight pilots and “Serious” for pilots up to 165 pounds. For the heavier category, that risk has been deemed acceptable based on the overall hazard risk index (consequence coupled with probability). For the lighter weight category, we have restricted pilots weighing less than 136 pounds from flying the F-35A and will continue to do so until the ejection system is fixed to an acceptable risk level. We are committed to providing an ejection system that meets requirements for the entire pilot demographic.

Mr. TURNER. The Marine Corps recently declared initial operational capability (IOC) in July 2015 with their version of the F-35. The Air Force is the next service in line to declare IOC in the Fall of 2016. Can you please give an overview on how the Air Force is progressing towards IOC and what, if any concerns you have in meeting the currently IOC timeline?

General HARRIGIAN. We are making steady progress toward IOC next year, and I am confident we will make IOC between 1 August and 31 December. There are three concerns we have for achieving IOC by 1 August 2016: 1) completing required aircraft modifications, especially the fuel overpressure modification, prior to 1 August, 2) delivering ALIS 2.0.2 software version to fully train operations and maintenance personnel on its deployed use, and 3) delivering one of the mission data files required for deployed operations (according to the current schedule) in time for a 1 August IOC declaration. We are diligently working with the Joint Program Office, Lockheed-Martin and Air Combat Command to mitigate these delays and achieve IOC on time.

Mr. TURNER. There has been spirited dialog in the press between the Air Force Chief of Staff, General Mark Welsh III, and the Director of Operational Test and Evaluation (DOT&E), Dr. Michael Gilmore with respect to F-35 Comparative Testing during Initial Operational Test and Evaluation (IOT&E). Can you please describe the Air Force position on Comparative Testing and how the planning is going for the F-35 Comparative Tests?

General HARRIGIAN. We fully support comparative testing during F-35 Initial Operational Test and Evaluation (IOT&E). As The Department of Defense’s independent test organization, the Director of Operational Test and Evaluation, his staff

and Joint Operational Test Team at Edwards are working to include comparative testing in the IOT&E plan without undue impact on schedule and cost. We fully support that effort.

Mr. TURNER. A January 2015 flight test demonstrated that the F-35 was not as maneuverable as an F-16, the very aircraft it's supposed to replace, in a dogfight. Can you comment on the conclusions of that test and the implications for F-35s in combat?

General HARRIGIAN. Both operational and developmental testing continues for the F-35. The F-35 is designed to be comparable to current tactical fighters in terms of maneuverability, but the design is optimized for stealth and sensor superiority. News reports on the F-35's performance against an F-16 was an early look at the F-35's flight control authority software logic, and not an assessment of its ability in a dogfight situation. The Operational Test Wing has just completed the first two phases of the within visual range (WVR) Tactics Investigation (TI) consisting of Aircraft Handling Characteristics and Basic Fighter Maneuver exercises. Comments from the operational testers state that the "Initial handling results are generally positive at this stage of tactics development and are comparable to current tactical fighters." Operational units are just starting to train their pilots on these first two stages of WVR tactics.

The F-35 has been optimized for the current trends in air warfare, where the enemy is engaged and defeated from long distances, but it will still be able to maneuver aggressively when required to defeat and kill threats.

Mr. TURNER. At our hearing in mid-April, General Bogdan reported improvement in aircraft availability rates to around 55 percent, and improvement in the aircraft's mission capability rate to about 65-70 percent. What are the goals for aircraft availability and mission capability rates for the operational use of the F-35, and do you agree with this assessment and do you see aircraft availability and mission capability rates improving to meet your requirements?

General HARRIGIAN. The USAF minimum (threshold) targets for aircraft availability and mission capability rates to support operational squadrons are established via a Bilateral Annex between the USAF and the F-35 Joint Program Office as part of the F-35 Performance Based Arrangement. Threshold rates to support USAF F-35 Initial Operating Capability (IOC) in 2016 are 60 percent for both aircraft availability and mission capability. Following IOC, threshold and objective aircraft availability and mission capable rates are specified in the Performance Based Arrangement for 2017 through 2019 for training, non-deployed and deployed aircraft. The rates are required to increase for all three categories across this time period. By 2019, threshold aircraft availability requirements for training/non-deployed/deployed aircraft will be: 65%/70%/75%. Objective aircraft availability requirements will be: 85%/90%/95%. In 2019, threshold mission capability requirements for training/non-deployed/deployed aircraft will be: 80%/80%/85%. Objective mission capability requirements will be: 90%/90%/95%.

During FY 15, the USAF fleet has achieved an aircraft availability rate of 55 percent and a mission capability rate of 66 percent. The USAF and Joint Program Office continue to drive readiness improvements into the fleet. Mission capability rates already exceed the 60 percent threshold and we are confident that air system performance trends and targeted efforts to improve air system availability will meet requirements to support IOC in 2016. The ability to meet increasing performance requirements following IOC is difficult to predict as the fleet is still maturing to a stable configuration and full rate production.

QUESTIONS SUBMITTED BY MR. JONES

Mr. JONES. What was the original budget projection in 2001 for the F-35 program?

How much have we invested thus far in the F-35 program?

How much is this over the original budget projection?

General BOGDAN. The original cost estimate for F-35 was \$226,458.3M (Selected Acquisition Report (SAR) from 2001). This included the cost to develop and procure 2,866 F-35 aircraft through the life of the program.

From FY01 thru FY15 appropriations, the amount invested is \$95,779.9M (RDT&E, Procurement, & MILCON).

The current estimate reported in SAR 2014 is \$391,134.7M or a 72% increase over the 2001 original cost estimate of \$226,458.2M. However, the program was re-baselined after the Nunn-McCurdy breach in 2012. Since the re-baseline, the program has maintained control of costs. In fact, projected costs have decreased by ap-

proximately 1.1% from the 2012 Acquisition Program Baseline (re-baseline) to the latest 2014 SAR (from \$395,711.8M to \$391,134.7M).

Mr. JONES. What was the original budget projection in 2001 for the F-35 program?

How much have we invested thus far in the F-35 program?

How much is this over the original budget projection?

General HARRIGIAN. This question is in the oversight and jurisdiction of the Joint Program Office and I defer to their answer of the same question.

QUESTIONS SUBMITTED BY MS. SPEIER

Ms. SPEIER. Has the F-35 program completed a full end-to-end cybersecurity testing of the F-35's operational system, and if not, when will it do so?

Has the F-35 program completed a full end-to-end cybersecurity testing of the F-35's operational system, and if not, when will it do so?

General BOGDAN. Cyber testing is a robustly-resourced and recurring activity that is foundational to the program's development. We constantly work with various agencies and experts to ensure survivability in a cyber-threat environment. The JPO has supported more than 2,000 cyber tests across all spectrums of the program including air vehicle, training systems, mission software, reprogramming laboratories and logistical support systems and has conducted close to 300 related tests this year alone.

The program conducts on-going independent Certification and Accreditation (C&A) activities to maintain current Authorities to Operate (ATOs) and Authorities to Connect (ATCs) on all DOD networks. These C&A activities include independent vulnerability and adversarial testing on production representative equipment. The F-35 program is in compliance with DOD Directive 8500.1 "Information Assurance" and views cyber testing as a core responsibility fundamental to mission success.

Operational Test (OT) continues to provide ongoing and continuous testing of each major increment of release of ALIS and Air Vehicle capability. OT has already completed separate and distinct Cooperative Vulnerability Penetration Assessments (CVPA) of the ALIS 1.0.3 Squadron Kit (at Edwards AFB) and ALIS 2.0.0.2 Squadron Kit (aboard the USS Wasp). This testing was followed by CVPAs of the ALIS 2.0.1 Squadron Kit (at Edwards AFB) and US Operational Central Point of Entry (CPE) (at Eglin AFB). Further testing will be accomplished in the spring of 2016 with end to end CVPA and Adversarial Assessments (AA) of the ALIS 2.0.1 system and integration of cooperative testing vignettes of the Block 2B Air Vehicle. Operational testing will continue with planned end to end testing of the ALIS system at release 2.0.2 and 3.0 as well as with the Block 3i and 3F Air Vehicle.

Ms. SPEIER. Does the Martin-Baker Water Activated Release System (MWARS) currently pose a "serious risk" to pilots' lives, and if so when will this system be retrofitted to reduce that risk?

General BOGDAN. Aircraft deliveries with ejection seats having MWARS installed started on LRIP 5 (2014). For aircraft delivered prior to LRIP 5, the JPO is currently retrofitting those aircraft with MWARS. The projected completion date is March 2016. A System Safety Risk Assessment was performed for those aircraft flying without MWARS, identifying a Medium level risk—one order of magnitude lower than a Serious risk. This risk was accepted by the US Services after coordination with Naval Air Systems Command (NAVAIR) and Air Force Life Cycle Management Center (AFLCMC).

Ms. SPEIER. Have any tests of the F-35 ejection seat been done in "off-nominal" conditions, simulating the impact on a pilot when the airplane is not flying straight at a relatively optimal speed? If so, what is the risk to pilots from performance in "off-nominal conditions"? If not, when will these tests be done?

General BOGDAN. Ejection seat tests have been conducted at "off nominal" speeds using both test sleds and an aircraft used by the Escape System community to test the ejection seat airborne. The F-35 specification, and corresponding development and qualification program, do not have any requirements for escape system sled testing to be performed in "off nominal" orientations. There are requirements to perform testing at "off nominal" speeds. The most common ejection speed is ~170 kts. Less than 10% of ejections occur above 400 kts. However the F-35 program has conducted more than 45 ejection tests above 400 kts to ensure the robustness of the system design.

Ms. SPEIER. When will ejector seat testing be completed using dummies weighing between 136 and 244 pounds?

General BOGDAN. 32 tests have been performed by the F-35 with manikins in that range. Six (6) additional tests will be performed as part of the qualification ef-

forts of the ejection seat redesign over the next 24 months with ejection seat qualification testing expected to complete in 3rd Quarter CY 2016.

Ms. SPEIER. The JPO has stated that the ejector seat and helmet will be fixed to eliminate risk to pilots by summer 2017. What will the consequences be if this risk is not eliminated on schedule?

General BOGDAN. If the risk is not eliminated on schedule, the Services will have to make a decision on maintaining the weight restriction limiting the F-35 pilot population to only pilots that weigh more than 136lbs. If the restriction is maintained, the safety risk will not increase over the risk currently assessed and accepted.

Ms. SPEIER. Is there an indemnity clause in the F-35 contracts that would render the U.S. government responsible for any deaths or injuries caused by these systems?

General BOGDAN. No, there is no indemnity clause in the F-35 contracts.

Ms. SPEIER. Regarding the acceptance of risk for the F-35 ejection seat, are there other comparable risks to the lives of U.S. service members that General Bogdan has signed off on and accepted?

General BOGDAN. Risk for in-service aircraft is accepted by the services, not the F-35 programs. Other escape system risks associated with the F-35 program include:

- A Serious level risk of fatal pilot injury with a probability of 0.7 per ten million flight hours for ejections outside of the Terrain Clearance Envelope.
- A Medium level risk of fatal pilot injury with a probability of 9 per ten million flight hours with ejections above 550 knots.
- A Medium level risk of severe pilot injury with a probability of 4 per ten million flight hours during ejection due to a design issue on the ejection seat shoulder harness.
- A Medium level risk of severe pilot injury for ejections above 450 knots when wearing a Gen III helmet (please note that this risk is not attributable to the design of the ejection seat. Injury could occur as a result of visor loss (9 per ten million flight hours) or head and neck loads (7 per million flight hours).

Each of these risks were recommended for Service acceptance by the Joint Program Office (JPO) and each Service followed its risk acceptance processes to evaluate (and accept) the risk.

Ms. SPEIER. Have the F-35 pilots currently flying the aircraft been notified of this "serious risk" of death, and what is the process by which they have acknowledged and accepted this risk?

General BOGDAN. This question is better answered by the US. Air Force and will be addressed in the same QFR sent to Maj Gen Harrigan.

Ms. SPEIER. What responsibility does Martin-Baker have for the ejection seat problem?

General BOGDAN. Martin-Baker is responsible for providing the ejection seat portion of the Escape System that provides a safe escape from the aircraft as required by the F-35 Specification. Lockheed Martin is responsible for the overall escape systems. The current escape system issues are caused by the combination of both seat performance and the Helmet Mounted Display (HMD) configuration. It is Martin-Baker's responsibility to resolve the issues that are caused by the ejection seat—namely, the sequencer and the parachute Head Support Panel are solutions designed by and incorporated by Martin-Baker to address the seat performance. It is Lockheed Martin's responsibility to provide an HMD configuration that addresses escape system issues caused by the HMD. Industry is paying for the design and test of these fixes.

Ms. SPEIER. Did considerations about U.K. participation in the F-35 program motivate the decision to award the contract to Martin-Baker?

General BOGDAN. No. The Joint Program Office (JPO) does not have a contract with Martin-Baker for the ejections seats. Martin-Baker is a subcontractor to British Aerospace (BAE), who is in turn a subcontractor to Lockheed Martin. The selection criteria for awarding the ejection seat to Martin-Baker were determined by Lockheed Martin and BAE during the source selection phase at the start of the program.

Ms. SPEIER. AT&L is proposing a block buy of over 400 F-35 aircraft in FY19 and FY20. Do you consider this a block buy, and if it were enacted, what incentive would the contractor have to fix problems like the ejection seat and mission fusion issues in aircraft that have already been purchased?

General BOGDAN. The Joint Program Office (JPO), in coordination with AT&L, is working to enter into a future Block Buy Contracting effort. The JPO intends to award a performance based specification for aircraft procured under a Block Buy Contract. Correction of deficiencies associated with any component will be required by industry in order for the contractor to meet contract specifications. The JPO will

not accept items that are deficient to contract specifications, and require industry to correct the deficiencies either before or after acceptance of the aircraft.

Ms. SPEIER. Has the F-35 program completed a full end-to-end cybersecurity testing of the F-35's operational system, and if not, when will it do so?

General HARRIGIAN. This question is in the oversight and jurisdiction of the Joint Program Office and I defer to their answer of the same question.

Ms. SPEIER. Does the Martin-Baker Water Activated Release System (MWARS) currently pose a "serious risk" to pilots' lives, and if so when will this system be retrofitted to reduce that risk?

General HARRIGIAN. This question is in the oversight and jurisdiction of the Joint Program Office and I defer to their answer of the same question.

Ms. SPEIER. Have any tests of the F-35 ejection seat been done in "off-nominal" conditions, simulating the impact on a pilot when the airplane is not flying straight at a relatively optimal speed? If so, what is the risk to pilots from performance in "off-nominal conditions"? If not, when will these tests be done?

General HARRIGIAN. This question is in the oversight and jurisdiction of the Joint Program Office and I defer to their answer of the same question.

Ms. SPEIER. When will ejector seat testing be completed using dummies weighing between 136 and 244 pounds?

General HARRIGIAN. This question is in the oversight and jurisdiction of the Joint Program Office and I defer to their answer of the same question.

Ms. SPEIER. The JPO has stated that the ejector seat and helmet will be fixed to eliminate risk to pilots by Summer 2017. What will the consequences be if this risk is not eliminated on schedule?

General HARRIGIAN. Based on data analysis, the Air Force made the decision to restrict F-35 pilots weighing below 136 pounds (high risk for serious or fatal injury). This policy only affected one pilot. We will continue this risk mitigation until the ejection system is fixed and the risk level is acceptable. Martin Baker is currently working on permanent and potential interim solutions. We have set the requirement for the ejection system to accommodate the entire pilot demographic from 103 to 245 pounds. Ultimately, the Air Force wants a seat that meets that requirement.

While cost and schedule could be factors in finding a solution, the performance of the ejection system is a priority to ensure the survivability of our pilots.

Ms. SPEIER. Is there an indemnity clause in the F-35 contracts that would render the U.S. government responsible for any deaths or injuries caused by these systems?

General HARRIGIAN. This question is in the oversight and jurisdiction of the Joint Program Office and I defer to their answer of the same question.

Ms. SPEIER. Regarding the acceptance of risk for the F-35 ejection seat, are there other comparable risks to the lives of U.S. servicemembers that General Bogdan has signed off on and accepted?

General HARRIGIAN. This question is in the oversight and jurisdiction of the Joint Program Office and I defer to their answer of the same question.

Ms. SPEIER. Have the F-35 pilots currently flying the aircraft been notified of this "serious risk" of death, and what is the process by which they have acknowledged and accepted this risk?

General HARRIGIAN. The commanders of all Air Force Wings currently flying the F-35A have notified their pilots of the serious risk. Additionally, to ensure understanding of the risk information, a Flight Crew Information File (FCIF) was disseminated to all F-35 flying units. Pilots are required to acknowledge any FCIF prior to flying. This FCIF contained the information from the Air Force Airworthiness Authority System Safety Risk Assessments for both serious risk acceptances as well as Air Combat Command direction restricting pilots weighing less than 136 pounds from flying until further notice.

Ms. SPEIER. What responsibility does Martin-Baker have for the ejection seat problem?

General HARRIGIAN. This question is in the oversight and jurisdiction of the Joint Program Office and I defer to their answer of the same question.

Ms. SPEIER. Did considerations about U.K. participation in the F-35 program motivate the decision to award the contract to Martin-Baker?

General HARRIGIAN. This question is in the oversight and jurisdiction of the Joint Program Office and I defer to their answer of the same question.

Ms. SPEIER. AT&L is proposing a block buy of over 400 F-35 aircraft in FY19 and FY20. Do you consider this a block buy, and if it were enacted, what incentive would the contractor have to fix problems like the ejection seat and mission fusion issues in aircraft that have already been purchased?

General HARRIGIAN. This question is in the oversight and jurisdiction of the Joint Program Office and I defer to their answer of the same question.

QUESTIONS SUBMITTED BY MR. LAMBORN

Mr. LAMBORN. Could you please provide complete data of ejection seat envelope testing (whether each test was successful or unsuccessful at various pilot weights and airspeeds): one for all testing performed with the Gen II helmet, and the other for all testing performed with the Gen III helmet? I am particularly interested in what testing has been done in the middle of the envelope versus the edges.

General BOGDAN. Ejection testing is typically performed for one of two reasons: 1) as a development test to evaluate the performance of concept under consideration or 2) to demonstrate performance of a planned flight configuration to support airworthiness certification of the system. Tests done under the first objective are not given formal success/failure designations, whereas tests performed under the second objective are. Tests that are not accepted as supporting airworthiness certification or are accepted but result in a need to get formal risk acceptance are considered unsuccessful. Tests that are accepted as supporting airworthiness certification without the need for risk acceptance are considered successful. Tests in which insufficient data was collected or the test method compromised the test are considered no-tests.

Figure 1 below depicts the weights and speeds at which Gen II and Gen III Helmet Mounted Display (HMD) ejection tests have been performed. Testing has been performed at different pilot weight and ejection speed conditions, including the middle of the envelope. The aircraft development program has included multiple seat and HMD configurations. From May 2007 to Dec 2010 forty-five (45) ejection tests were performed utilizing a Gen II HMD. From Oct 2013 to the present, twelve (12) ejection tests have been performed for the Gen III HMD. The forty-five (45) tests performed with the Gen II HMD break out as follows:

- 7 development tests done with the System Development and Demonstration (SDD) version of the ejection seat (no pass/fail)
- 1 failure with the SDD version of the ejection seat, which was addressed by a seat design change
- 1 failure with the SDD version of the ejection seat that required risk acceptance
- 4 successful tests with the SDD version of the ejection seat
- 10 development tests done with the production version of the ejection seat (no pass/fail)
- 2 no-tests (no pass/fail)
- 1 failure with the production version of the ejection seat, which was addressed by a seat design change
- 19 successful tests with the production version of the ejection seat

Five of the tests with the SDD seat and four of the tests with the production seat were conducted with mid-weight manikins. The airworthiness certification for the Gen II HMD in the LRIP ejection seat included 19 successful tests conducted with manikins weighing from 103, 136, and 245 lbs at speeds ranging from 0 to 550 kts.

Of the twelve (12) Gen III tests conducted to date, seven (7) tests have been unsuccessful. These test failures have resulted in aircrew restrictions and risk acceptance for the impacted pilot weights. Design changes to the HMD and the ejection seat are being pursued. The failed tests will be repeated with the design changes in place. [See Figure 1 next page.]

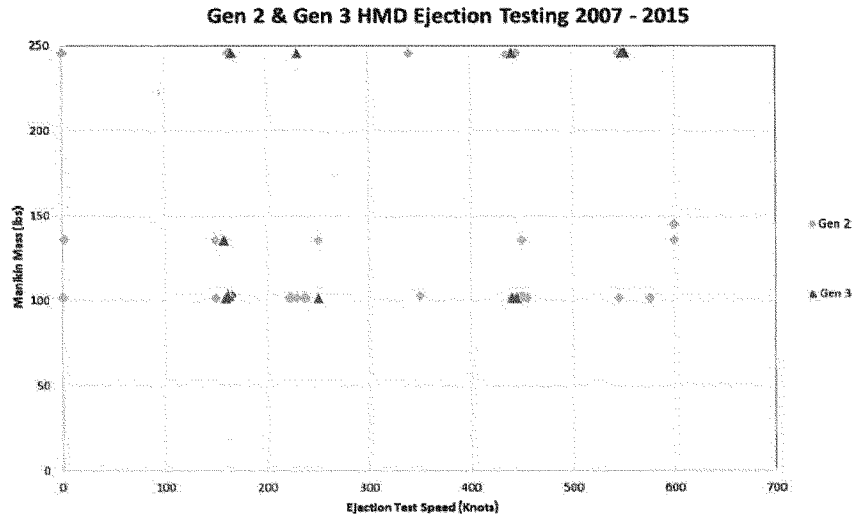


Figure 1—Gen II and Gen III HMD Ejection Tests

Mr. LAMBORN. Could you please provide a summary of how many ejection seat sled tests have been performed to date, the period of time that encompasses, and the total cost incurred by the U.S. taxpayer to date? How many additional sled tests will be required to certify the current F-35 ejection seat as fully qualified, as well as validate the three proposed solutions, and what will be the corresponding cost to the U.S. taxpayer?

General BOGDAN. Ejection testing began in 2005 and has carried through 2015. These tests included:

- Eight (8) tests in 2005 performed as proof of concept testing, utilizing Gen I HMDs and other early model/legacy helmets. These tests were not performed with Gen II or III HMDs.
- Sixteen (16) tests in 2006 developing and certifying the -1 seat for use in the first F-35 aircraft. These tests utilized Gen I HMDs or legacy helmets (not Gen II or III HMDs).
- 31 tests between 2007 and 2009 developing and certifying the -2 seat for use in the System Development and Demonstration (SDD) aircraft, 13 of which were performed using Gen II HMDs. None were performed with Gen III HMDs. The rest utilized Gen I HMDs or legacy helmets.
- 32 tests between 2009 and 2010 developing and certifying the -4 seat for use in the Low-Rate Initial Production (LRIP) aircraft, all of which utilized Gen II HMDs.
- Four (4) tests between 2012 and 2014 assessing potential seat changes, utilizing Gen I or legacy helmets.
 - NOTE: These 4 were Design Verification Tests run completely by Martin-Baker. The F-35 JPO was not involved in those tests and did not fund those tests.
- Twelve (12) tests between 2012 and 2015 developing and certifying the Gen III Helmet Mounted Display (HMD) for use in SDD and LRIP aircraft, all of which utilized Gen III HMDs.

The current plan is to perform approximately 25 ejection tests to qualify the final ejection seat/HMD solution. At approximately \$500K per test, the cost of 99 funded tests to date is approximately \$49.5M, and \$12.5M for the remaining planned tests.

Mr. LAMBORN. Regarding the “Light or Heavy” switch, what would be the consequences if a pilot ejects with the switch inadvertently in the incorrect position?

General BOGDAN. If a pilot ejects with the switch inadvertently in the incorrect position they would have an elevated risk of injury during a particular phase of the ejection sequence based on their weight:

If a light weight aircrew ejected with the switch in the heavy weight setting, they would have an elevated risk of injury due to parachute opening shock. It is expected that the risk of injury would be of a similar order of magnitude to the risk of injury

to a similar weight aircrew ejecting from legacy aircraft with a Helmet Mounted Display (HMD).

If a heavy weight aircrew ejected with the switch in the light weight setting, they would be at increased risk of impacting the ground prior to the parachute decelerating them to a safe descent velocity if they were to eject at low altitude. It is expected that the risk of injury would be of a similar order of magnitude to the risk of injury to similar weight aircrew ejecting from legacy aircraft. There is not increased risk to a heavy pilot ejecting at higher altitudes if the switch were improperly set to the light weight setting.

The hazards associated with inadvertent or incorrect selection will be reviewed to ensure controls are implemented to minimize the realization of this risk.

Mr. LAMBORN. Could you please provide your corresponding analysis that leads you to conclude that there is not any increased risk of injury for pilots weighing more than 136 pounds?

General BOGDAN. The analysis performed does show a slightly increased level of risk for pilots in the 136–165 lbs weight range, but that injury potential is significantly lower than for the < 136 lbs weight population. The analysis, contained in a System Safety Risk Assessment, assesses the risk at the Serious level. This is a conservative assessment based upon a set of worst case assumptions to determine the appropriate level within the Department of Defense at which the risk acceptance needed to be made. This approach assures that the safety risk is not underestimated and provides a worst case assessment of the pilot risk.

This risk was recommended by the Program Executive Officer, Lt Gen Bogdan for US Service acceptance. Both the USAF and USN/USMC have accepted the risk associated with this pilot population.

Mr. LAMBORN. Who exactly are the “air-worthiness authorities” making risk assessments and decisions for the F–35 ejection seat?

General BOGDAN. Airworthiness is a DOD/Service responsibility that flows from US Code Title X to DOD, and then to the commanders of Naval Air Systems Command (NAVAIR) and Air Force Life Cycle Management Center (AFLCMC). For fielded aircraft, airworthiness authority resides with VADM Grosklags, Commander, NAVAIR for F–35Bs and F–35Cs, and Lt Gen Thompson, Commander, AFLCMC for F–35As.

For test aircraft in the Development program, the F–35 Program Executive Officer (PEO), currently Lt Gen Chris Bogdan, is the airworthiness authority. Gen Bogdan uses his Program Office staff and the NAVAIR and AFLCMC engineering staffs to make recommendations on the airworthiness of the Developmental test fleet.